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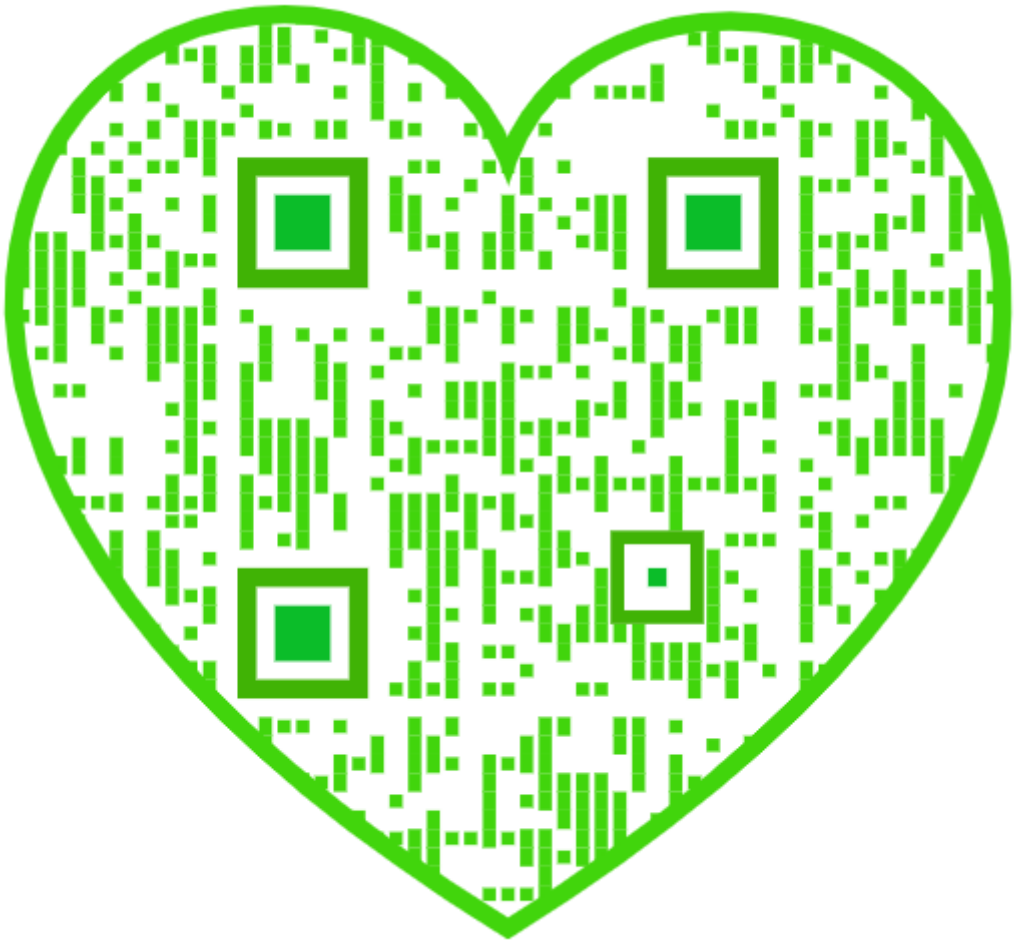

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Relative Position of Skeleton and Soft Parts of Fowl.

The

Diseases of Poultry

BY

D. E. SALMON, D. V. M.,
Chief of the U. S. Bureau of Animal Industry.

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PREFACE.

The author has for years given attention to the diseases encountered in the poultry-yard, and long since became impressed with the desirability of a systematic treatise on the subject. The pamphlets, by various authors, which have appeared in the English language have been very useful, but they have been far too brief, they have not contained the results of modern investigations and they have lacked illustrations. There have been more extensive monographs in German, French and Italian, but these have been, for the most part, sealed books to English-speaking poultrymen.

It has been necessary for the author to examine much of the literature of this subject in order to keep abreast with the progress of science and to reply intelligently to the numerous inquiries which he has received. The notes thus made led to the writing of a number of articles for the press, which were so well received and brought out so many requests for more information, that it was decided to fill in the parts which had not been touched upon and produce a small reference book for the use of those interested in the subject. This volume is the result, and it is hoped that it may prove useful to the thousands who are annually under the necessity of struggling with the problem of disease in the poultry-yard.

The author has, in the preparation of this work, consulted with much profit the *Medecine des oiseaux*,

of Pierre Megnin, the *Encyclopedie Cadeac*, The Diseases of Poultry by J. Woodroffe Hill, the Comparative Anatomy and Physiology of Vertebrates by Richard Owen, the *Traite de zoologie medicale et agricole* by A. Railliet, *Die Krankheiten des Hausgeflugels* by Friedrich Anton Zuern Neumann's Parasites and Parasitic Diseases of Domesticated Animals, translated by Fleming, and the bulletins and circulars of the Bureau of Animal Industry prepared by Theobald Smith, V. A. Moore, C. W. Stiles and A. Hassall, as well as many valuable articles in the veterinary periodicals.

If this volume is the means of attracting more attention, in this country, to the diseases of birds, if it saves a part of the loss which now occurs from such diseases, and if it serves to mitigate the sufferings of these uncomplaining but highly sensitive creatures, the purpose of the author will be accomplished.

D. E. Salmon.

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CHAPTER I.

Introduction.

THE POULTRY INDUSTRY—HEALTH AND DISEASE—THE ORGANS AND APPARATUS AND THEIR FUNCTIONS—COMMON CAUSES OF DISEASE—HYGIENIC REQUIREMENTS—DISINFECTION—OBJECTS OF MEDICAL TREATMENT.

THE POULTRY INDUSTRY.

THE domesticated birds, which we group together under the general term "poultry," constitute a very important part of the "farm animals" of the country. Their number and value are enormous. There were in 1890 according to the census 258,871,125 chickens or dung-hill fowls and 26,738,315 other domesticated fowls in the United States. This gives a total of 285,609,440 individual fowls. The number at present in the country is undoubtedly much larger than in 1890.

The annual earnings of American poultry amount to an immense sum, and have been estimated all the way from $200,000,000 to $350,000,000. The truth lies somewhere between these extremes, but sufficient data has not been collected to enable any one to reach a very accurate conclusion. It is certain, however, that the poultry industry constitutes one of the most important branches of agriculture, and that it is well

worthy of the most careful study and attention. About 820 million dozens of eggs were returned in the census of 1890, with no account of dressed poultry, feathers, &c. Nothing relating to such an industry is beneath the talents or dignity of the most learned and able persons in the land. It is only the thoughtless and ignorant who speak slightingly of the "chicken business," or who consider it inferior to any other occupation.

HEALTH AND DISEASE.

The success of poultry raising depends upon the ability of those engaged in this industry to keep their birds thriving, vigorous, and free from disease. From an economical point of view birds are machines which consume certain kinds of raw material and produce eggs and meat. They should be kept in such a condition that they can most profitably work this transformation. One of the most serious obstacles to profitable poultry keeping is the effect of diseases in arresting the productive activity of the flock and in decimating its numbers. More failures in the poultry business are traceable to disease than to any other cause. A knowledge of the nature, prevention, and curative treatment of the more common diseases of fowls is, therefore, essential to success in this industry; and a treatise on this subject for ready reference must necessarily be one of the most useful articles in the poultryman's outfit. These diseases are treated with considerable detail in this volume, but before entering upon the study of the individual diseases, it will be of great assistance to get a clear idea of what constitutes disease, how it is caused and upon what principles it may be prevented and cured.

We say a bird is in good health when it appears

lively, has a clear eye, a bright red comb, is quick and active in its movements, has a good appetite and when the various organs of the body perform their functions in the manner in which they are observed to act in all birds that are vigorous and thriving. On the other hand, we say a bird is diseased when some function or functions of its body are not performed as they are in the great majority of individuals, or when some organ presents an unusual form or appearance. Disease has, therefore, been defined as a life the manifestations of which deviate more or less from the normal. Practically, we say a bird is diseased when we observe that one or more of its functions are not carried on in a normal manner, or when we find unusual growths, injuries, or parasites affecting any of its organs.

THE ORGANS AND APPARATUS AND THEIR FUNCTIONS.

In the study of disease, one of the most important things is to acquire the habit of looking at a bird, not as one indivisible object, but as an individual made up of many distinct parts, each of which has its special function to perform. Thus, we find the beak, the tongue, the œsophagus, the crop, the proventriculus, the gizzard, the pancreas, the liver, and the intestines, each separate and distinct in itself, and each liable to be affected by disease. We observe also that these organs taken together make up the *digestive apparatus* and that they are associated together for the purpose of obtaining, preparing, and assimilating nutritive material for the sustenance of the body as a whole. We are often able to determine that there is something wrong with the working of an apparatus before we are able to locate the trouble in one or more organs. To ascertain the seat of a disease and understand its nature,

we must, consequently, know the different organs of the body, we must know what work each organ does, and how the organs are associated for the accomplishment of a common purpose.

Besides the digestive apparatus, we find in the bird's body the nostrils, larynx, trachea, lungs and air-sacs which together constitute the *respiratory apparatus*. The principal functions of this apparatus are to supply oxygen to the blood and receive in return carbonic acid gas and watery vapor. Then, there is the circulatory apparatus, composed of the heart, arteries, capillaries, veins, and lymphatics, which carries the nourishment and the oxygen to every part of the body and brings away the waste and worn out material. There is the urinary apparatus, made up of the kidneys and the ureters, which separates and removes from the blood the great part of the waste of the body which can not be vaporized and carried away with the air expired from the lungs. There is the genital apparatus which in the male consists of testes, vas deferens, and, with some varieties, a penis, and in the female of ovaries, and oviducts, the purpose of this apparatus being the reproduction and perpetuation of the species. There is the locomotive apparatus and framework of the body, made up of the bones, ligaments, muscles, and tendons. There is the brain and nervous system which establishes communication between and governs the different organs and apparatus. And, finally, there is the tegumentary system, which includes the skin and feathers and the function of which is to cover and protect the body, and excrete a certain amount of liquid bearing with it some soluble waste products from the blood.

COMMON CAUSES OF DISEASE.

In order to act intelligently for the prevention and cure of a disease, we must know something of its cause; and in order to determine the cause, we must know the agencies which are liable to injuriously affect the diseased organ. If it is found that the digestive organs are affected, we are naturally led to inquire into the character and quantity of food that has been taken; the amount of exercise which the birds have had; whether they have had access to gravel or grit; whether the alimentary canal is obstructed at any point; whether the affected birds have been unduly exposed to cold or to draughts of air; and, finally, whether they have been attacked by any of the parasites, vegetable or animal, which are known to cause disturbance of the digestive functions. If the respiratory organs are diseased, it is proper to inquire if the birds have been chilled or exposed to draughts of air, or to a damp atmosphere; or whether they are the prey of parasitic organisms such as multiply in this portion of the bird's body. If the skin, comb, wattles, or feet are affected, the most likely causes are freezing, mechanical injuries, and parasites. If lameness is exhibited it is probably due to injuries or rheumatism. If the general health is affected as shown by mal-nutrition, paleness, and loss of weight, the most common causes are indigestion from improper food, and the attacks of internal or external parasites. Diseases of the brain result from exposure to too great heat, and sunstroke, from over exertion, and from too high feeding with insufficient exercise. Diseases of the ovaries and oviducts result from the bird being too fat; from these organs being over-stimulated, or from the ration being improperly adjusted to the needs of the body.

These are by far the most common causes of disease with the domesticated birds. There are other causes, such as rupture of a blood vessel from weakness of its walls; the degeneration of the tissues of important organs through some obscure influence; the inexplicable failure of some part of the body to perform its functions and the development of abnormal growths. These are more commonly observed, however, in old birds, and, as financial considerations lead to the frequent renewal of the poultryman's stock, such forms of disease rarely occur and are confined to a very few birds.

HYGIENIC REQUIREMENTS.

The conditions required for the maintenance of health and vigor in a flock of birds, are similar to what are required for other animals. These conditions, however, are more important with birds than with quadrupeds because the activities of the former are more intense. That is to say the bird digests more food in proportion to its weight, it breathes more rapidly, its blood circulates faster, its temperature is higher, and it makes a proportionate increase in weight in a shorter time. The bird may, therefore, be compared to a very perfect and delicate machine running under a high pressure. If properly managed, such a machine gives the very best results; but if neglected and run under improper conditions, it soon fails to be satisfactory and may entirely collapse.

One of the first problems which the poultryman is called upon to solve is the location of the poultry plant. There are some general principles which are of great assistance in considering this question. The building or buildings should be upon an elevated spot where the drainage is good, and any danger of water settling

under the building during heavy rains should be guarded against by filling in with a foot or more of earth before the construction is commenced. It is a great advantage to have soil which contains enough sand to prevent the quick formation of mud and which soon dries. Dampness in the houses and mud in the yards are not favorable conditions for poultry raising.

The next condition of importance is a proper amount of space in the houses and yards. This depends somewhat upon the size of the birds and whether a shed is attached to the house. Houses without sheds should have from six to fifteen square feet to each adult bird, while those with sheds may be reduced to about one-half this space. The yards should be large enough to allow exercise in the open air, and large enough to supply more grass than the birds will eat. This will vary from 60 to 150 square feet per adult bird. The open shed facing the south, where the fowls can be induced to hunt for their food and take exercise in all seasons of the year, and where they can enjoy the pleasure of scratching and dusting themselves in the sunshine, even during the Winter months, is of great assistance in maintaining the health and productiveness of the flock.

The ventilation of the poultry-house should be provided for in such a way that draughts of air will not strike the birds. The amount of ventilation required will depend largely upon the height of the house, the atmospheric temperature and the velocity of the wind. In northern latitudes, with buildings of moderate height, the problem in winter is rather to keep the cold out than to let the air in. When the weather is not too cold, however, the admission of plenty of fresh air is important and particularly so if the walls and roofs of

the houses are made air-tight with one or more layers of building paper. There are various methods by which such houses may be ventilated without endangering the birds with currents of air, but as the details of these methods depend largely upon the plan of building adopted, they will not be discussed in this volume.

Cleanliness is an essential sanitary condition for all animals, but particularly so for birds. Accumulations of excrement harbor parasites, vitiate the atmosphere and breed contagion. The poultry-house should, therefore, be constructed with a view to its frequent, easy, and thorough cleaning. The roosts and nest boxes should be removable, so that all parasites which collect upon them may be reached and destroyed. The floor should be smooth to permit scraping and sweeping. Cracks and knot holes should be avoided as they furnish a hiding place for parasites. Low boxes containing dry earth or road dust should be provided in which the birds can take a dust bath with regularity.

DISINFECTION.

Disinfection is the destruction or removal of infection. Infection of poultry-houses and runs occurs from the introduction of animal and vegetable parasites, including the various microbes and unknown forms of contagion. There are no precautions which will entirely prevent such infection. The fowls with which the flock is started will probably be already infected with many varieties of parasites. Wild birds and various animals or possibly the attandant may bring contagion and even the larger animal parasites. Some of these parasites multiply in the birds' bodies, others breed in the houses, still others pass a portion of their life cycle in or upon the soil of the runs.

The longer fowls are kept upon the same premises, the more these parasites will increase, and the greater damage and menace they will be to the flock. Systematic and efficient measures must, therefore, be instituted and regularly employed in order to keep such pests in check, and, if possible, entirely eradicate them. Some species of parasites are quite easily controlled, but others will tax the ingenuity and skill of the poultryman to the utmost.

The methods of disinfection applicable to the poultry plant are numerous, and it is important to understand those which are most available and which can be used with least danger to persons and fowls. For the inside of the houses, including the roosts and nest boxes, hot lime wash is one of the best applications and should be used at least twice a year. If thoroughly applied, it will destroy both animal parasites and microbes. The disinfecting power of lime wash may be increased by the addition of one-fourth pound carbolic acid to each gallon. When a gaseous disinfectant is needed to reach the ceilings of houses and the hangings of brooders, formalin (formaldehyde) will be found by far the most efficient. It may be sprayed over the inside of the house or brooder in a three to five-per-cent solution, and if the doors and windows are then tightly closed, so that the vapors will be confined, every part of the interior of the structure will be disinfected. Formalin may now be purchased in a forty-per-cent solution and may be diluted with water to the desired strength. One pound of the solution added to a gallon of water makes a mixture of about the proper strength.

For the destruction of the external animal parasites many apply kerosene oil and crude petroleum to the

roosts, but these substances are not to be compared in efficiency with hot lime wash. The fowls themselves may be dusted with insect powder or dipped in a creolin solution (2 per cent), and insect powder may be added to the dust baths and strewed in the nests when the vermin become troublesome. Other remedies suitable to special conditions will be given in subsequent chapters.

The runs should be occasionally plowed, in order to bury the accumulated excrement and parasites, and at the same time bring fresh soil to the surface. If this does not prove sufficient for the purpose, the soil should be covered with a good coating of lime or thoroughly saturated with a five-per-cent solution of carbolic acid some days before it is plowed, and no fowls allowed upon such runs for six months or a year.

If in spite of these precautions, intestinal worms become more and more injurious, or if one or more of the various diseases caused by fungi, bacteria, or protozoa continue to affect the birds, the only resource is to move the flock to fresh ground. In starting a new flock, or in removing to a new locality to escape parasites, it is a good plan to leave the old birds behind, and only take young ones which have been hatched in incubators and which have never been outside of clean brooders. The adult birds would certainly carry many parasites with them, while these young birds should be uninfected.

OBJECTS OF MEDICAL TREATMENT.

In the treatment of sick birds, medicines should not be administered blindly, but on the contrary there should be a clear idea, before the remedy is selected, of what is to be accomplished. Otherwise, it is probable that

more harm than good will result. In giving medicines intelligently there are three distinct objects which one may attempt to accomplish:

1. To neutralize, remove or destroy the cause of the disease.

2. To cause the repair of the affected tissues.

3. To counteract or remove the symptoms.

1. As to the first object mentioned, it is clear that we can only direct our remedies towards the cause, when that cause continues to act. In catarrh, pneumonia, inflammation of the intestines, and other diseases which result from exposure to cold, for example, the cause may have been a cold draught of air on a windy night. When the bird is discovered to be sick, a day or two later, the cause is no longer acting. On the other hand, in parasitic diseases, the cause continues to act, as a rule, until it is destroyed by remedies or by the vital processes of the body. These examples are simply illustrations of the general fact that there are only a part of the diseases that affect birds, in which an attempt can be made to reach the cause.

There are special methods of treatment applicable to the epizoa or external animal parasites, and quite different methods for the entozoa or internal animal parasites. Likewise the treatment for epiphytes, or external vegetable parasites, may differ widely from that applied to entophytes or internal vegetable parasites. In all these cases, however, we endeavor to remove or destroy the cause of the disease. Poisoning may be treated upon the some principle; that is, an attempt may be made to neutralize, destroy or remove the poison. Whenever possible, the remedies should be directed to the cause of the disease, since while this continues to act a cure is impossible.

2. To secure the repair of the affected tissues is also a very important object of medication. Wounds may require stimulating or astringent treatment; inflammations may be reduced by cooling applications or by sedatives; an anæmic condition is counteracted by tonics; the congestion of an internal organ may be relieved by inducing increased circulation at the surface of the body either by heat or counter-irritation. These are examples of treatment applied to relieve the abnormal condition and secure the repair of the diseased part. When the cause of the disease has ceased to act, this line of treatment should be adopted, if possible.

3. There are, unfortunately, many cases in which it is neither possible to adopt treatment for the removal of the cause or the repair of the affected part. In such cases we are limited to *symptomatic medication*. The effort then is to mitigate the alarming and dangerous symptoms. There are many conditions in which such a course is of great advantage. Thus, when the forces of the body are weakened or exhausted this state may be temporarily relieved with stimulants; when the temperature is dangerously high, it may be reduced by appropriate remedies; when pain is severe it may be arrested by drugs which act upon the nerves; when there is constipation, laxatives or purgatives may be indicated, and when there is purging it may be stopped with medicines having the opposite effect; for spasmodic contractions of the muscles, there is a class of medicines called antispasmodics; and there are drugs which increase the various secretions. It is plain, therefore, that while removing the cause of disease, and working for the repair of the affected parts are scientific and essential plans of treatment, the symptomatic

method, also, has its applications which will be found both numerous and important.

The intelligent treatment of disease will be conducted with one or more of these three objects in view. We may at the same time apply remedies to destroy a parasite, and to allay the irritation or heal the injuries which it has caused. It is, also, possible in certain cases to simultaneously attack the cause of disease, to treat the local injury and to beneficially modify the urgent symptoms. The skill of the practitioner is shown by the resources with which he is able to meet and overcome the varied conditions of disease which confront him at different times and with different individuals. To be successful he must be able to accurately determine the nature of the disease and the condition of the patient.

CHAPTER II.

Diseases of the Organs of Respiration.

STRUCTURE AND FUNCTION—SIMPLE CATARRH—ROUP, CONTAGIOUS CATARRH—BRONCHITIS—THE GAPES, VERMINOUS TRACHEO-BRONCHITIS, SYNGAMOSIS—CONGESTION OF THE LUNGS, PULMONARY CONGESTION—PNEUMONIA—MYCOSIS OF THE AIR-PASSAGES, ASPERGILLOSIS—THE AIR SAC MITE.

STRUCTURE AND FUNCTION.

THE respiratory organs of birds differ considerably from those with which we are familiar in the other species of domesticated animals. The plan of structure of these organs follows more closely the analogous organs of reptiles than it does those of mammals. This should not excite surprise as it is now admitted that birds are descended from some animal of the reptilian group.

The lungs are confined, as they are in the tortoise, to the back part of the body cavity, and are firmly attached to the ribs and the spaces between these bones. Large membranous sacs, communicating with the lungs and serving as reservoirs of air, extend to the posterior portion of the abdomen and even into the bones. The lungs are not suspended freely and divided into lobes as we see them in other farm animals, but they are attached to the back part of the chest and are accu-

rately molded to the inequalities of the ribs and the spaces between the ribs.

Notwithstanding these resemblances to the sluggish cold-blooded animals, the bird's breathing apparatus is of the highest order of excellence, and wonderfully effective. The lungs are comparatively small and have little elasticity, but there is a compensation for these features in the free communication with the spacious air sacs which contain an abundant supply of air.

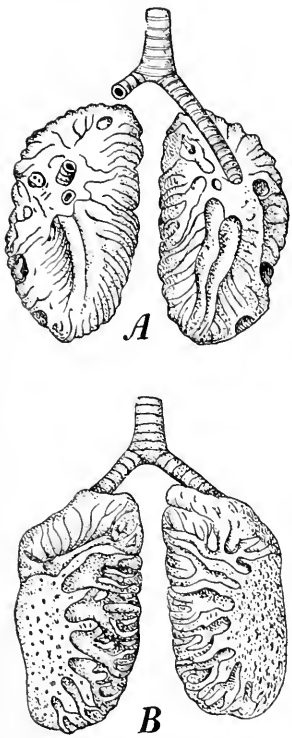

Fig. 1.—Lungs of a Bird.
A.—Lower Surface.
B.—Upper Surface.

The upper opening of the trachea or windpipe is on the floor of the mouth just behind the tongue. The larynx at the beginning of the windpipe, which is such a perfect structure in the higher mammals, is in birds only slightly developed. The edges of the larynx appear to close together so perfectly that no epiglottis or lid is necessary. There are no vocal cords in the larynx as in mammals, and therefore this organ can not produce voice, and it only raises or lowers a note by bringing together or separating the stiff margins of the opening. The true organ of voice in birds is the lower larynx or syrinx, which is

found in no other class of animals and is situated where the trachea divides to form bronchi.

The two primary bronchi, formed by the division of the trachea, penetrate the lungs, branching as they go and end in the air sacs which have already been mentioned. The primary branches of the bronchial tubes give off secondary branches, and the secondary branches in turn send off tertiary branches. These finer branches open upon a dense network of minute, almost naked, blood vessels, through the delicate walls of which the oxygen passes to the blood and the carbonic acid and other vapors escape.

There are in all nine air sacs, four on each side, and one (the interclavicular) which has been formed by the union of another pair. These are named the cervical, the interclavicular, the anterior thoracic, the posterior thoracic, and the abdominal sacs. With many birds the air sacs extend into the humerus or large bone of the wing, with some, into the breastbone, the thigh bone, and even other bones of the body. The air sacs act principally as reservoirs of air, feeding the lungs between the periods of inspiration and ensuring an abundant air supply at all times. There is possibly some oxygenation of the blood through their walls, and they serve in addition to reduce the weight of the body.

Nearly all the moisture which escapes from the bird's body passes off through the respiratory organs. With mammals, a large proportion of the liquid taken into the body is evaporated from the surface of the skin, and this process serves as an efficient regulation of the body temperature. A considerable amount of liquid is also excreted by the kidneys of such animals. In birds the secretion of the kidneys contains but a small quan-

tity of water, and the skin has no sweat glands, so that but an insignificant amount of moisture is evaporated from the external surface of the body. The lungs and air sacs of birds must, therefore, perform not only the duties which devolve upon the respiratory organs of mammals, but also largely those of the kidneys and skin as well.

On the whole, the bird's respiratory apparatus is very perfect and more active than that of any mammal. The quantity of carbonic acid exhaled is very large, the breathing is rapid, and the oxidation of the blood is necessarily thorough to maintain the high temperature of the bird's body. With all of this, birds are capable of great and prolonged muscular exertion; the "wind" of the Homing Pigeon, for instance, being something remarkable.

The intimate connection which exists between the bronchi and air sacs readily permits of the extension of a disease process from one to the other, and parasites or parasitic diseases may be common to both. Injured birds may even breathe through a broken humerus which has pierced the skin, when their windpipes are obstructed with blood and impermeable to air. In this case the air is drawn into the lungs through the interclavicular air sac instead of penetrating by way of the trachea and bronchi. The respiratory apparatus of birds differs, therefore, to a remarkable extent from that of other animals, in structure, in function, and in the development and extension of the diseases to which it is subject.

SIMPLE CATARRH.

One of the most common diseases of birds is catarrh. It is sometimes mild, attacks but a few birds in a flock and is easily overcome. At other times it is more

severe, affects all or nearly all the birds in a flock and only yields to energetic and prolonged treatment. In case of long-continued cold and damp weather, birds in different flocks may be affected at the same time, leading to the suspicion of an infectious disease, although it is really due to climatic conditions acting over a large territory at the same time. It is important to make a careful examination as soon as the disease appears and to determine whether it is *simple catarrh* or *infectious catarrh*, as the treatment to be adopted in the two cases differs materially.

SYMPTOMS.— In simple, non-contagious catarrh, the affected birds are more or less dull, they are disinclined to move, their appetites are diminished, they sneeze and the mucous membrane is thickened, causing some obstruction to breathing through the nostrils. There soon appears a thin, watery discharge which later becomes thicker and glutinous, the eyes are often watery, the eyelids swollen and sometimes held together by a thick, viscid secretion. In very severe cases, the birds are somnolent, the plumage is erect and roughened, the nostrils are completely obstructed by the thick secretion, the breathing is entirely through the mouth and is accompanied by a wheezing or snoring sound, the appetite is entirely lost, a thin liquid escapes from the mouth and the bird soon becomes exhausted and dies. In the milder cases simple catarrh may disappear without treatment, in the course of two or three days; or, in case the cause is allowed to persist, the birds may become worse and die, or the disease may become chronic and continue its effects for a long time.

CAUSATION.— Simple catarrh is the result of undue exposure to cold and dampness or to draughts of air. It is most commonly seen where the houses are damp and

filthy, with cracks and openings, through which the wind blows upon the fowls, or with birds that have been exposed to unusual cold and draughts in the show-room or during shipment from one place to another. The birds most apt to be affected are those having their strength already impaired by insufficient or innutritious food, by lack of exercise or by the attacks of parasites.

TREATMENT.— Catarrh is best prevented by keeping the birds in a strong, vigorous condition through proper exercise, good food, clean houses and ventilation without draughts. In case symptoms of this disease are observed, search out and remove the cause, and give the birds stimulating food with some cayenne pepper mixed into it.

If the disease appears serious, wash out the mouth and nostrils twice a day with boric acid solution of the strength of fifteen grains to the ounce of water, or creoline solution (one per cent). The following remedy is highly recommended by Megnin:

Gentian root	4	drams.
Ginger	4	"
Sulphate of iron . . .	2	"
Hyposulphite of sodium .	1	"
Salicylate of sodium . .	1	"

These substances are to be pulverized and then thoroughly mixed. The dose is three or four grains a day for a medium-sized fowl. Its effects are stimulating and tonic.

ROUP, CONTAGIOUS CATARRH.

Although much has been written upon the subject of roup, the scientific studies of the disease have been incomplete and there is still much difference of opinion as to its nature. It is particularly difficult, from pres-

ent knowledge, to say positively whether contagious catarrh and diphtheria are essentially one and the same disease or whether they constitute two distinct and unrelated plagues. Considering only the symptoms, it is possible to draw a sharp and definite line, as most veterinary writers have done, placing on the one side all those outbreaks which have only catarrhal manifestations, and on the other those which clearly show diphtheritic patches with false membranes. Dr. Moore's investigations seem to indicate that both diseases are caused by the same germ, the only difference being in the grade of virulence. If this inference should prove correct, it would justify the common usage of applying the term roup to both forms of disease. At present, however, it appears preferable and in accordance with the preponderance of evidence to describe them as two diseases rather than as two forms of the same disease.

Symptoms.—The early symptoms of this disease can not be clearly distinguished from those of simple catarrh, though the dulness and prostration are usually greater and there is often a peculiar offensive odor, which are valuable points to aid in reaching a decision. There is at first a thin, watery discharge from the nostrils with some obstruction to breathing from swelling of the mucous membrane. The discharge soon becomes thicker and more sticky or glutinous, causing the affected birds to sneeze and shake their heads in an effort to free the air passages. The subjects are dull, quiet, without much appetite and more or less feverish. The plumage is rough, the wings pendant, the comb and wattles dark red.

As the disease advances, the inflammation extends, from the mucous membrane of the nostrils along the internal surface of the passage connecting the nostrils

with the orbital space or cavity surrounding the eyes. The orbital space in birds is relatively very large and has an angular projection towards the point of the beak. There is, consequently, considerable space between the eye-ball and the bony walls surrounding it, which is known as the orbital space or orbital sinus. This space is lined with a mucous membrane which is continuous with that of the nostrils and in such close relations with it that an inflammatory process readily extends from one to the other. Very often in roup, this membrane is inflamed throughout these passages, and the process is so acute that the surface becomes eroded and ulcerated. The secretion, instead of remaining fluid as in simple catarrh, changes at this period, is abundant, thick, yellowish purulent, and cheesy. This secretion accumulates and obstructs the passages. It forms around the eye and forces the eye-ball out of the socket and at the same time collects under the eyelids or on the corner, sometimes simulating a false membrane. It, also, plugs the nasal passages, presses down the palate, obstructs the breathing and may prevent swallowing.

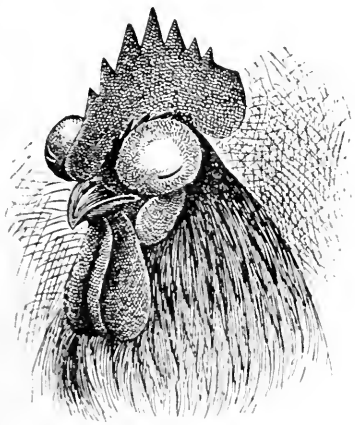

Fig. 2.—Head of bird affected with contagious catarrh.

The affected birds in the advanced stages of the disease present a most miserable appearence. The

beak is kept open in order to breathe, the sight is destroyed by inflammatory products, the eyes are often closed and bulging from the head, the breathing is very difficult, a thick, sticky discharge escapes from the nostrils, the subjects are emaciated, prostrated, sleepy and perhaps unconscious. When these severe symptoms appear, the strength is soon exhausted and death follows.

Contagious catarrh spreads rapidly through a flock, affecting the greater part of the birds and causing the death of a variable proportion according to the virulence of the contagion. It is always a very serious disease and is difficult to eradicate.

CAUSATION.— That roup is a contagious disease admits of no question. Its origin in a flock can frequently be traced to the introduction of a bird from some other premises where the disease exists. Often, it is contracted by exposure to affected birds at shows, or to the contagion clinging to coops, houses or infected runs. Many writers teach that roup may originate from exposure to cold or draughts of air. This prevalent opinion is probably accounted for by the fact that the first stages of roup are almost identical in their symptoms with simple catarrh or a common cold. It is not likely, however, that such exposure is sufficient to produce roup. Contagious diseases are caused by parasites, each specific disease having its particular species of animal or vegetable life to call it into existence, and without its particular parasite the disease can not be developed. It is, therefore, logical to conclude that if the germ or parasite of roup is not already infecting a given poultry yard, the disease will not appear until this parasite is introduced. Colds and catarrh may become aggravated and even fatal by neg-

lect and continued exposure to the existing causes, but they will not develop into roup unless the contagion of the last named disease is present.

The exact species of organism which causes roup can not be certainly determined from the investigations so far made. A bacterial organism resembling the bacillus of fowl cholera and that of rabbit septicæmia has been isolated from some outbreaks. Whether this organism or some other form of microscopic life constitutes the contagion makes little difference to the practical poultryman. The recognition of the existence of contagion in some form is the most important thing.

Roup is a contagious disease which is localized upon the mucous membranes of birds. That is, the microscopic parasite which causes the disease, develops and multiplies upon and within the mucous membranes of affected birds; escapes from their bodies with the discharge from the nostrils and eyes; soils their feathers, and, also, the litter and other objects about them; when dried it is dissipated throughout the surrounding air in the form of dust by every movement of the bird, or of the soiled objects, and by every breeze that disturbs the contaminated surfaces. This dust, containing the germs of the disease, as it floats in the air is drawn into the nostrils with the breath or lodges within the eye. When the germs reach the moist and warm surfaces of the membranes lining the nostrils or eyes, they find favorable conditions for their continued multiplication. They penetrate the membrane, set up irritation and inflammation, and as a result of this action there follow catarrh, ulceration and the formation of purulent and cheesy deposits about the head.

Treatment.— The measures to be adopted for the

prevention of roup are the same as for other contagious diseases. Exclude the contagion by every means that can be devised. Do not allow poultry, animals or men to come directly from an infected premises to a healthy flock. Be careful in buying new birds, and these as well as all birds that have been to shows should be isolated for two or three weeks until their healthfulness is demonstrated. If the disease once appears in the flock use disinfectants freely and isolate diseased individuals. If the birds are not very valuable it is sometimes better to dispose of every one, and after disinfection begin with new blood. The contagion is persistent and can only be eradicated by the most thorough measures.

The medical treatment may be undertaken with good chances of success, but requires time and constant attention. Whether it will pay, depends upon the value of the birds and of the services of the party who cares for them. Antiseptic and healing applications are indicated to the interior of the nostrils, the cleft of the palate, the eye, and other affected parts. If swellings containing thick pus or cheesy matter form upon the head, they should be opened with a sharp instrument, the contents removed and the wound treated with antiseptics. Antiseptic powders are convenient for treating the wounds caused in such operations. Among these iodoform and aristol are the best. The wound may be kept filled with either of these powders until it is healed. The antiseptic solutions may be injected into the nostrils or into the cleft in the roof of the mouth which communicates with the nostrils, by using a small syringe, a medicine dropper, or even an oil can, such as is used for oiling machinery. A syringe is, of course, the best. The solutions most suited are boric

acid fifteen grains to the ounce of water; carbolic acid or creoline in two per cent solution; peroxide of hydrogen diluted with an equal quantity of water; permanganate of potash one grain to the ounce; or sulphate of copper five grains to the ounce. Some persons have reported great success from the use of coal oil (kerosene) either pure or diluted with equal parts of olive oil. Megnin has had excellent results with a five per cent solution of sulphate of copper injected into the nostrils, the cleft of the palate, the affected eyes and the wounds made in removing purulent collections from the sinus in front of the eyes. This solution appears rather strong and should be used at first with care and in an experimental way until its effects are seen. When the head shows signs of considerable inflammation it may be anointed with sweet (olive) oil, vaseline, or equal parts of sweet oil and coal oil.

In selecting from the remedies mentioned, it is well to begin with the milder ones, such as boric acid, peroxide of hydrogen or carbolic acid. Keep the birds comfortable and free from draughts of air. Give stimulating and easily digested food containing a small proportion of meat scrap. One writer, Mr. Mapes, believes that he has controlled the disease effectually with a properly balanced ration. It is important to dispose of the carcasses of dead birds promptly by burning or deep burial.

BRONCHITIS.

CAUSATION.—Inflammation of the mucous membrane of the trachea and bronchial tubes, or bronchitis, is sometimes due to the extension of the catarrhal process from the head, or it may be induced by the action of the causes which produce catarrh. The most frequent of these causes are exposure to dampness, to

cold, to draughts of cold air, and to sudden and extreme changes of temperature. This disease may, also, result from the inhalation of irritating vapors, dust, and other foreign substances. A careful discrimination should be made between bronchitis arising from such causes and that due to contagious catarrh (roup), tuberculosis, gape worms, and the aspergillus fungus.

Symptoms.—The birds are somewhat dull, with loss of appetite, accelerated breathing and cough. On listening to the respiration a blowing or whistling sound may be heard in the air tubes, in the early stages of the disease, caused by the air being drawn over the dry and thickened membrane; later, a rattling or bubbling sound is heard caused by air passing through accumulations of mucus. In the majority of cases the symptoms are not serious, and, under favorable conditions, they soon disappear. Occasionally, the malady increases in intensity, the plumage becomes rough, the wings droop, the breathing is labored and difficult, the bird frequently opens its beak in order to obtain sufficient air, it is sleepy, torpid and exhausted. In such severe forms of the disease a large proportion of the affected birds die.

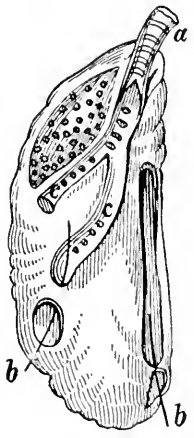

Fig. 3.—Right lung of a goose; *a*, primary bronchus; *bb*, openings through which communication is established with the air sacs; *cc*, secondary bronchi.

Treatment.—The first indication in simple bronchitis is to place the affected birds in a comfortable, dry and reasonably warm place, where they will not be subjected to draughts of air, but where the ventilation is good. Give soft and cooling food, such as stale bread,

or a mixture of bran and middlings moistened with milk. Inhalation of steam, or vapor from boiling water in which hops or a small quantity of carbolic acid or creoline has been placed, is beneficial. Give with the food two grains of black antimony twice a day. A small quantity of flax seed steeped in hot water makes a demulcent drink that often gives great relief; and, in the absence of this, honey or gum arabic may be added to the drinking water with advantage. If the attack promises to be severe, it may sometimes be checked in the early stages by giving ten drops of spirits of turpentine in a teaspoonful of castor oil and repeating this dose after five or six hours. It should not be continued after there are signs of purging, for fear of exhausting the strength of the patient. In the very acute cases, where the whistling or snoring sounds with the respiration indicate a croupous form of inflam-

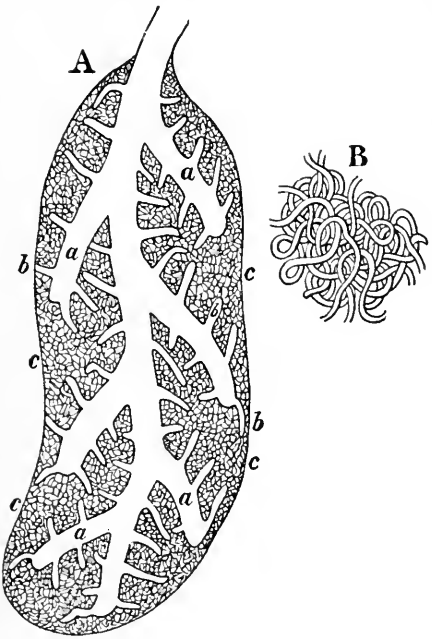

Fig. 4.—Lung of a bird represented in ideal longitudinal section: *aa*, secondary bronchi. B, dense network of minute blood vessels which makes up the greater part of the lung tissue and to which the tertiary bronchi convey the air.

mation, and where the gasping shows great obstruction of the air passage, relief may be obtained by giving from three to six drops of either the syrup or the wine of ipecac.

Medicines should be administered very carefully in diseases affecting the trachea and bronchi, as otherwise they may enter the air passages and increase the irritation.

THE GAPES, VERMINOUS TRACHEO-BRONCHITIS, SYNGAMOSIS.

The gapes is a parasitic disease of birds, caused by the presence in the trachea or windpipe, of a worm called the *Syngamus trachealis*. The most prominent symptom of this disease is frequent gaping, and from this characteristic the affection takes its name.

HISTORY.—The gapes appears to have been first observed and described as occurring in the United States. This disease was seen by Dr. Wiesenthal in 1799, at Baltimore, Md., where he states it affected hens and turkeys. It was reported by Georges Montagu as prevailing among chickens in England from 1806 to 1809. This author believed that chickens were the only occupants of the poultry yard which become its victims, since he observed turkeys and ducks living on the same premises with infested chickens but remaining free from the disease. He observed that pheasants were similarly affected at the period when the appearance of the plumage changes so that the sexes can be distinguished. He also saw the disease in partridges.

Both Wiesenthal and Montagu recognized that the disease was caused by worms which inhabited the trachea, producing inflammation and obstructing the passage of the air.

This disease has been very prevalent among fowls

and game birds in England during the last twenty-five years; and it has been estimated that it destroys, there, half a million chickens annually, in addition to the losses among game and other birds. It has, also, caused serious losses in France for more than forty years, and undoubtedly exists in many other countries. In the United States, it has become one of the most common and most troublesome diseases of young chickens and young turkeys, but adult birds as a rule do not suffer from it. A number of species of wild birds are susceptible to this disease as well as the domesticated birds.

CAUSATION.— The single cause of gapes is the parasitic worm known as the *Syngamus trachealis*. This worm is represented in Fig. 5, *a* being the male and *b* the female. The two sexes are usually joined together in a permanent manner by the union of the integuments, as shown in the figure.

The syngamus is a small round worm, red in color, and both the male and female are found attached by their mouths to the mucous membrane of the bird's trachea. The female is slightly more than one-half inch in length, while the male is only one-fifth inch.

They suck the blood of the bird, which forms their nourishment, and, in doing this, set up considerable irritation and even inflammation. The large and vigorous birds are not seriously disturbed by the presence of this parasite, particularly if the worms are not very numerous. Small and weak birds, however, are unable to successfully resist the combined effect of the loss of blood, the inflammation of the trachea, and the obstructed respiration. The strength is rapidly lost, and the windpipe becomes obstructed until finally the bird dies of exhaustion or asphyxia.

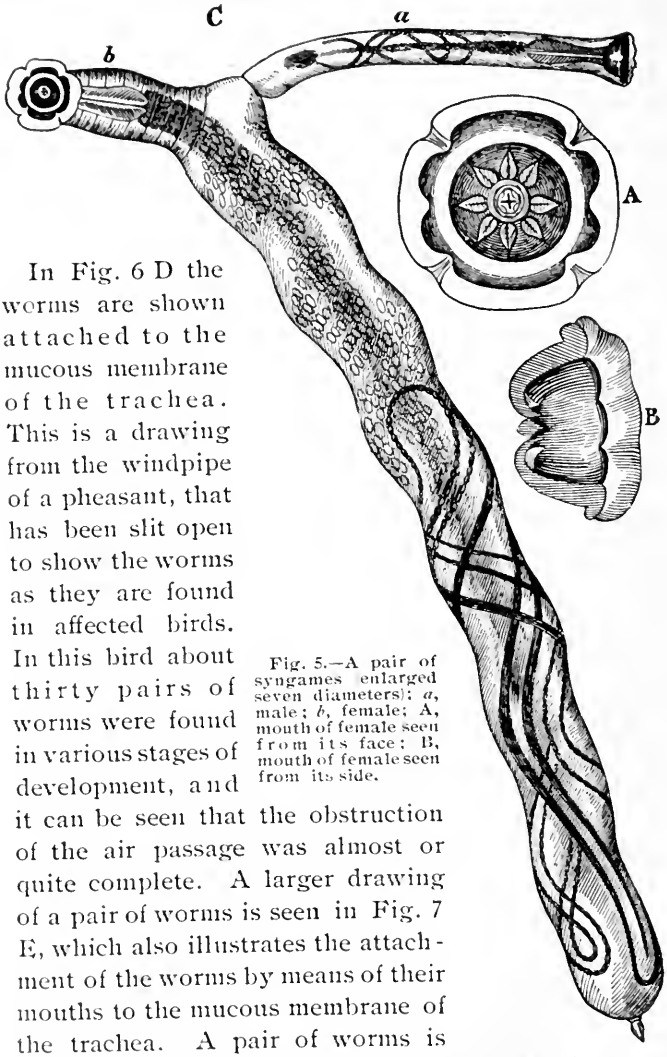

Fig. 5.—A pair of syngames enlarged seven diameters): *a*, male; *b*, female; A, mouth of female seen from its face; B, mouth of female seen from its side.

In Fig. 6 D the worms are shown attached to the mucous membrane of the trachea. This is a drawing from the windpipe of a pheasant, that has been slit open to show the worms as they are found in affected birds. In this bird about thirty pairs of worms were found in various stages of development, and it can be seen that the obstruction of the air passage was almost or quite complete. A larger drawing of a pair of worms is seen in Fig. 7 E, which also illustrates the attachment of the worms by means of their mouths to the mucous membrane of the trachea. A pair of worms is shown still more enlarged in Fig. 5, in order to give some

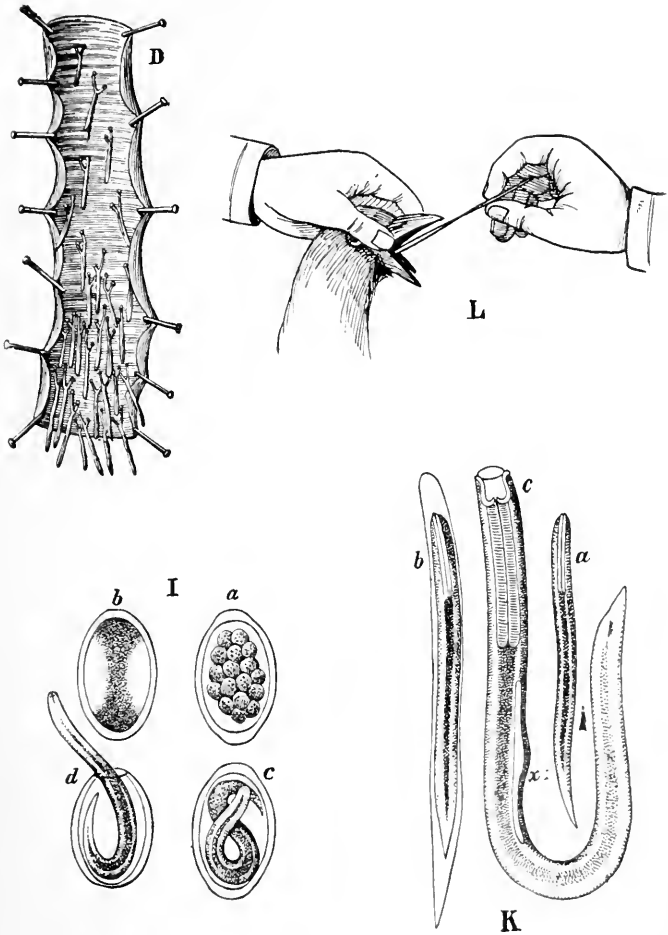

Fig. 6.—D, trachea of pheasant opened to show syngames (two-thirds natural size). I, ova in different stages of development, *a*, segmented vitellus, *b*, granular vitellus becoming constricted at middle, *c*, ovum with embryo fully developed, *d*, ovum with valve at extremity detached and embryo emerging; K, embryos, *a*, directly after leaving egg, *b*, undergoing the first molt, *c*, nymph with rudiments of genital organ showing at *x*; L, diagram illustrating manner of removing syngames with wire, horse-hair or feather.

idea of their structure. The cup-shaped mouth, technically called the buccal capsule, the œsophagus and the intestinal canal can be easily made out. In the female, *b*, can be faintly seen the uterus and its horns filled with ova, or eggs, and coiled around the uterus and intestines is the clearly-defined ovarian tube. In the male *a* the elongated testicle is shown coiled about the digestive tube. A, shows the mouth of the female as seen from its face; and B, shows the same part as seen from the side.

The reproductive organs of the female are seen in Fig. 7 G, in which *a* represents the uterus, *bb* the uterine horns, *cc* oviducts or Fallopian tubes, and *dd* ovaries. The reproductive organs of the male are shown in Fig. 7 H, *a* being spicules, *b* spermatic canal, *c* vesicula seminalis, and *d* testes. Fig. 6 I, is a drawing of the ova, or eggs, in different stages of development. The segmented vitellus appears at *a*; at *b* the vitellus is granular and becoming constricted at its middle, the embryo developing laterally, *c* shows the ovum with embryo fully developed and folded like the figure 8, *d* the ovum with the valves at the extremities detached and the embryo emerging.

The characters of the embryos are clearly shown in Fig. 6 K, where *a* represents the embryo directly after it leaves the egg; *b* is an embryo somewhat older and undergoing the first molt; *c* is the nymph, the rudiments of the genital organ showing at *x*.

Young birds become infected with this parasite either by eating the adult worms, containing eggs, which are coughed up by affected birds, or by taking the embryos with the food or drink. It is not necessary that the syngamus should pass any period of its existence outside of the bird's body, although it is capable of

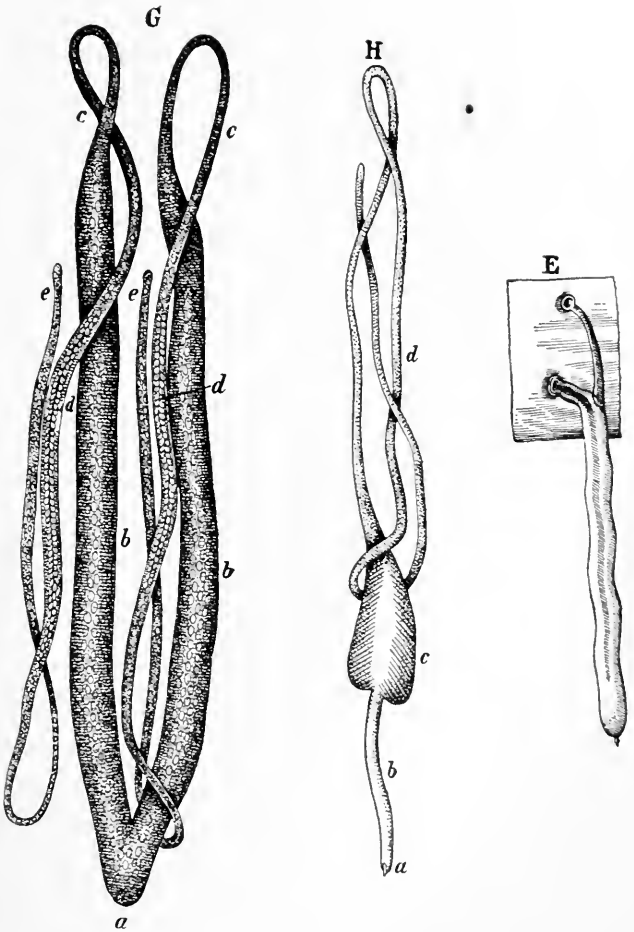

Fig. 7.—*Syngamus trachealis;* G, reproductive organs of female enlarged six diameters; *a*, uterus, *bb*, uterine horns, *cc*, oviducts, *dd*, ovaries; H, reproductive organs of male, *a*, spicules, *b*, spermatic canal, *c*, vesicula seminalis, *d*, testes; *E*, pair of syngames, illustrating attachment to the mucous membrane.

living and partially developing under such conditions. The eggs may escape from the adult female worm in the trachea of the bird and these eggs may hatch and the embryo develop in the trachea of the same bird. Hence this is a parasitic disease in which the parasites may continue to develop and increase indefinitely in the body of the host, after the first infection has occurred. As the syngamus does not lay its eggs, however, and as these are only freed by the rupture of the body of the adult worm, usually after its death, the most frequent course of reinfection must be through the digestive organs of the bird.

When the adult egg-bearing worms are coughed up by diseased birds, these worms are eagerly seized and devoured by chickens or grown fowls. In such cases, while the worm is no doubt digested and destroyed in the alimentary canal of the chicken, the eggs which it contained are hatched and some of the embryos find their way to the trachea of the bird. It is not known how these embryos travel from the digestive organs to the trachea. No doubt the path is a difficult and dangerous one for them; because, although there are some thousands of eggs in the adult worms, ten or fifteen worms have been fed to a single chicken, and, as a result, not over four or five embryos would reach and develop in the trachea. Probably a great many of the eggs pass through the intestines and are voided with the excrement before they hatch.

The eggs, or the embryos, or both, of the syngamus are undoubtedly scattered over the grounds where the infested chickens run. Some of these pass through the digestive organs and are scattered with the excrement as just suggested; others are coughed up and out of the mouth, or the adult worms may be coughed up, and

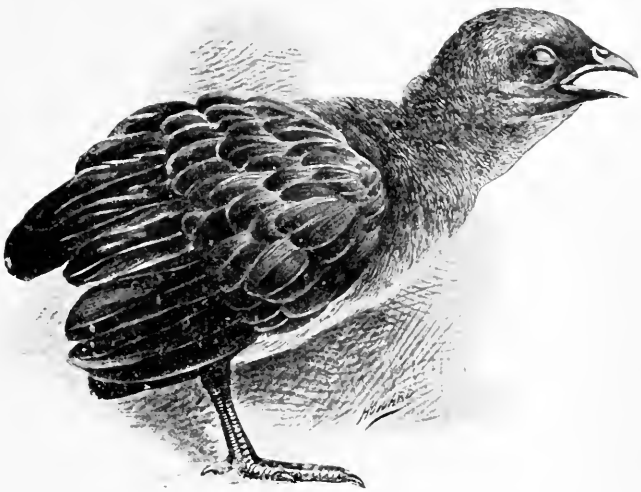

Fig. 8.—Chicken affected with gapes.

the eggs and embryos are set free by the disintegration of the worm. The eggs require warmth and moisture to hatch, and similar conditions are needed for the life of the embryos. These newly-hatched embryos may be at once taken up by birds, with contaminated food or drink, and thus cause infection; or they may be taken into the digestive canal of earth worms, as has been shown by Walker, and be carried for some time by such earth worms. It has been shown conclusively that earth worms from infected poultry runs will cause gapes if fed to chickens. Whether or not the earth worm plays an important part in sheltering and protecting the embryos of the syngamus and in thus maintaining the infection upon certain premises is not definitely known.

Walker considers the earth worm a very important

factor in keeping up infection, and has proposed the destruction of these worms by saturating the soil with a solution of common salt. Whether this will kill or drive away the earth worms which are in the soil has not been satisfactorily demonstrated.

Symptoms.—The disease is observed most frequently in young birds from one to four weeks old. The affected individuals are seen to be less lively than usual; they extend the head frequently and widely open the beak—that is, they gape. If watched, they are seen to gape every minute or two, and as the disease progresses, this gaping is repeated several times a minute.

The birds soon begin to cough, making a sudden, whistling sound something like a sneeze, whitish mucus may be rejected from the nostrils or mouth, or worms (syngames) may be coughed up. If badly affected the birds become anæmic and weak; the feathers are roughened; the wings droop; the neck is shortened or drawn up, except when extended for gaping; the bird shakes its head, often convulsively, as if trying to get rid of a foreign body in its throat. The affected birds are no longer able to keep up with the flock to which they belong, they lag behind, stop as if exhausted, stand with closed eyes and allow themselves to be easily caught. At this period they are liable to attacks of suffocation, from which they may die suddenly. Others apparently die from weakness and exhaustion.

The stronger birds, particularly if only infested with a few worms, and the older and larger birds, are not so severely affected. They gape occasionally, but their general health is not impaired. Their strength is re-

tained, they search for and take the usual quantity of food and they soon regain their former activity.

The nature of the disease may be readily determined from the symptoms above enumerated. If, however, there is any doubt, the trachea of a bird which has died from the disease should be slit open and examined for the syngamus. In case no birds have died, one of the methods for extracting the worms from the trachea of the living bird should be tried (see treatment). It is important to the poultryman that the nature of the disease should be detected as soon as possible after it appears upon his premises in order that precautions may be taken to stop the spread of the infection and to eradicate it from the place.

TREATMENT.—Separate the sick birds from the well ones as soon as the disease is detected and clean up the coops, pens and houses where they have been.

Disinfect all these places and also the drinking troughs or cups with a five per cent solution of crude carbolic acid or with boiling water. Burn the bodies of the birds which die. Keep the infected birds in a house which can be easily cleaned and disinfected, and see that this house is kept disinfected with hot water or five per cent carbolic acid solution. Megnin recommends for disinfecting enclosures and contaminated runs, sprinkling with a solution of one part of salicylic or sulphuric acid in one hundred of water. Provide pure water and uninfected food.

By careful manipulation the worms may often be removed from the trachea and the chicken radically cured in that way. To accomplish this either a feather or a long hair from the horse's tail may be used. If a feather is selected it is stripped of the web except near the tip. This may be used dry or it may be moistened with coal

oil or oil of turpentine. If a horse-hair is to be used it is folded and the two ends twisted together so as to leave a small loop at the folded extremity. To extract the worms the chicken's mouth is forced open with the fingers of the left hand (Fig. 6 L) and, when the glottis opens for breathing, the feather or hair is thrust into the opening and downward into the trachea. It is then turned or twisted around several times and withdrawn, when one or more worms may be found adhering to it, or in other cases are coughed up, having been loosened by the feather or hair. These worms should all be burned as they are capable of spreading the infection. Great care should be used in these manipulations as the larynx and trachea are very tender and sensitive and are liable to serious injury from a broken or rough feather; or the bird may be suffocated by obstructing the breathing for too long a time.

Internal treatment is highly recommended by some authorities. Megnin had excellent results in treating affected pheasants with garlic. He made a mixture consisting of hard-boiled eggs, boiled beef's heart, the crumbs of stale bread and salad. These ingredients were chopped, pounded and thoroughly mixed so as to make a paste. To this paste was added pounded garlic in the proportion of one bulb to ten pheasants each day, the garlic being thoroughly distributed through the paste. This mixture was greatly relished by the birds. Others who tried this remedy found that the birds refused to eat it, but that they would eat garlic in the form of a salad. Megnin also recommends assafœtida, seven and one-half grains daily to a pheasant, used as a powder combined with an equal quantity of yellow pulverized gentian and mixed with the paste that was

fed to the birds. He asserts that this treatment succeeded completely within a few days.

Some have obtained satisfactory results by administering camphor in the form of pills, the dose being one-half to one grain twice a day. Others have succeeded with sulphur, giving one to three grains at a dose.

Those engaged in raising birds should depend rather on prevention than cure. The value of a three-weeks-old chicken is not sufficient to justify a great expenditure of time in its treatment. The effort should be made to place the young birds on uninfected ground, or the runs should be kept thoroughly disinfected. On the first appearance of the disease remove and isolate the affected birds and take the necessary precautions to secure the destruction of all the parasites they contain. By such measures the propagation of the worm will be prevented and the extension of the disease will be avoided.

SYNGAMUS BRONCHIALIS.

A worm closely related to the *Syngamus trachealis* has been described in Europe as affecting young ducks and goslings. It is found in the finer bronchial tubes preventing the ingress of air and causing death from asphyxia. It sets up much irritation and even causes croupal pneumonia. The symptoms are similar to those caused by the *Syngamus trachealis*, but more violent, and sudden deaths due to obstruction of the air tubes are common. This worm has been named the *Syngamus bronchialis*, and is combated by the preventive measures and internal remedies recommended for the *Syngamus trachealis*.

CONGESTION OF THE LUNGS, PULMONARY CONGESTION.

Congestion of the lungs, or engorgement of the pul-

monary blood-vessels is a disease which quite frequently affects birds that are molting, and also young chickens, ducks, goslings, pheasants, and cage birds. The distention of the blood-vessels which are very abundant in the lungs, causes pressure upon the finer bronchi and air cells and may lead to death from asphyxia. Or there may be rupture of the vessels and the escape of blood, which blocks up the bronchi and alveoli and collects in the air sacs. In either case death soon results.

CAUSATION.— This disease is generally caused by exposure to cold and the chilling of the surface of the body, which leads to contraction of the external blood-vessels and forces an undue amount of blood into the internal organs. It is seen in fowls that are molting and which are exposed to cold draughts or rain while the skin is over-sensitive and partially denuded. It also occurs in young birds which, for any reason, are not kept sufficiently warm. It is common among young chickens and turkeys allowed to run out in the rains of early Spring, and among incubator chicks that are allowed to get chilled.

Congestion of the lungs may also occur in full-fed, plethoric birds from over-abundance and too great richness of the blood. This liquid then becomes thick and circulates with more difficulty than when in a normal condition; the delicate vessels in the lungs become clogged, distended and finally ruptured. This form of the disease is the result of improper feeding and lack of exercise and is seen most frequently in cage birds.

SYMPTOMS.— The affected bird breathes rapidly and with difficulty. It is indisposed to move, stupid, sleepy, and does not notice what is going on about it. Thick

mucus tinged with blood may escape from the mouth. The comb is dark red or bluish from lack of oxygen in the blood. The symptoms appear suddenly and the bird lives but a few minutes or hours.

TREATMENT.— The treatment of congestion of the lungs in birds must consist entirely of measures for its prevention, since the course of the disease, when it has once developed, is exceedingly rapid and fatal. Young birds and fowls which are molting should be guarded from exposure and cold, particularly when wet. Birds in confinement should be given a varied ration with green food, roots, or fruit and plenty of exercise. When birds are dying from any cause a careful examination of the carcasses should be made. If the lungs are found very dark in color and distended with blood, particularly if blood has escaped into the bronchi and air sacs from ruptured vessels, this indicates the nature of the disease and should lead to the adoption of proper measures of prevention. Medical treatment of sick birds is impracticable on account of the rapid progress of the disease.

PNEUMONIA, INFLAMMATION OF THE LUNGS.

One of the most common diseases with our four-footed animals is inflammation of the lungs, technically called pneumonia, but this malady appears to be much less common with birds. Some veterinarians who have given considerable study to this subject state that they have never seen typical pneumonia in these creatures. There is no doubt, however, that it does occur quite frequently, and that it is essentially the same in symptoms, nature, and effect as the pneumonia of mammals.

Pneumonia is an alteration of the lungs which is

one step beyond congestion. If a bird is affected with congestion of the lungs and does not die or recover within a few hours, the disease may develop into pneumonia. In this disease there is not only distention of the bloodvessels, as with congestion, but there is thrown out from these vessels a liquid which fills the air-cells and by coagulating forms a semi-solid, gelatinous substance, that excludes the air and renders the lungs useless for respiration. The lung is then darker in color than in health, and when pressed upon gives a sensation of firmness and solidity comparable with the liver; therefore, the lung in that condition is said to be hepatized.

CAUSATION.—Two factors are believed to work together in the production of pneumonia. There must be the conditions which produce congestion, viz., refrigeration, chilling of the surface of the body, disturbance of the general circulation from some cause, inhalation of irritating vapors or plethora; and there must apparently be something else. This additional factor is in many cases, at least with the larger animals and man, a species of the bacteria. The same probably holds true with birds.

It appears that the bacteria which change congestion into inflammation are germs which under ordinary circumstances are harmless, and which may often be found upon the surface of the mucous membrane of healthy animals. Now, if there are simultaneously in the same animal, germs which are sufficiently active, and, also, a congestion of the lungs, there have been brought together the conditions required to develop pneumonia.

SYMPTOMS.—The symptoms are similar to those seen in pulmonary congestion. The breathing is rapid,

difficult, and painful. There may be coughing with discharge from the mouth or nostrils of thick, adhesive mucus, grayish or yellowish in color or tinged with blood. The bird stands with ruffled plumage, drooping wings, head drawn in, and every appearance of severe illness. There is loss of appetite from the first, with thirst and constipation.

On examination of the lungs after death one or both of these organs are found dark in color, engorged with blood and solidified. The pneumonia may take either one of two forms. There may be what is known as broncho-pneumonia, in which case the inflammation affects more particularly the bronchi and the lung is not much solidified. The bronchial tubes in this case are more or less filled with thick mucus and exudate. In the other form, called croupous pneumonia, the tissue of the lung is principally affected. It is then that the lung is solidified by the filling up of the air-cells. A piece of lung so affected, if dropped into a bucket of water, sinks to the bottom while healthy lung tissue will float. The bronchial tubes and air-sacs are also in some cases filled with a thick, yellowish fibrinous exudate which blocks up these air-passages and becomes partly solidified.

TREATMENT.—This is a rapid and fatal disease with birds and one in which treatment is very unsatisfactory. The bird should first of all be taken into a warm room and covered with a piece of blanket, if the weather be at all cold, leaving its head uncovered, so that there will be no obstruction to its supply of fresh air. It should be given linseed tea frequently, but a small quantity at a time, as a drink. This tea is made by pouring a pint of boiling water on an ounce of flaxseed and keeping the mixture hot but not boiling for two

hours. The seeds are then removed by straining and the mucilaginous liquid which has valuable demulcent properties may be kept before the affected bird as a simple drink or it may also be used as a vehicle for certain medicines. Sufficient nitrate of potash should be dissolved in the drink so that the bird will take about one grain three times a day. If the patient appears to be failing and becomes very sleepy with a dark bluish color of the comb and gills, mix fifteen drops of tincture of digitalis with one ounce of water and administer ten drops of this mixture every two hours. In dropping such medicines it is best to use a medicine dropper, as drops of more uniform size are obtained. Great care should, also, be observed in administering the medicine to avoid its getting into the air-passages and causing strangulation. When the bird begins to improve, a grain of quinine or ten drops of cod liver oil twice a day, will hasten recovery. The food during sickness and recovery should be nutritious and digestible. A small quantity of warm milk, or milk and egg beaten together, or chopped raw beef may be offered from time to time, while the attack lasts and as the appetite returns gradually replace with mash or more solid articles of food. The disease may be prevented by the measures mentioned in the article on congestion of the lungs.

MYCOSIS OF THE AIR-PASSAGES, OR ASPERGILLOSIS.

Several species of fungi or molds may develop within the air-passages of animals, and particularly of birds, and cause serious disease. These fungi all belong to the genus *Aspergillus*, the parasitic species being in the order of their importance as follows: *Aspergillus fumigatus*, *Aspergillus nigrescens*, *Asper-*

gillus glaucus, and Aspergillus candidus. Usually these fungi are found in nature growing upon dead organic matter; but they have great vegetative and resisting power and are able to adapt themselves to various conditions of existence. Many species of birds are affected by them, the disease caused by their development having been observed in pigeons, pheasants, fowls, ducks, geese and swans, as well as in various cage and wild birds. Pampered and delicate birds are believed to be most frequently attacked. The disease may take on the characters of an epizootic and attack a large number of individuals.

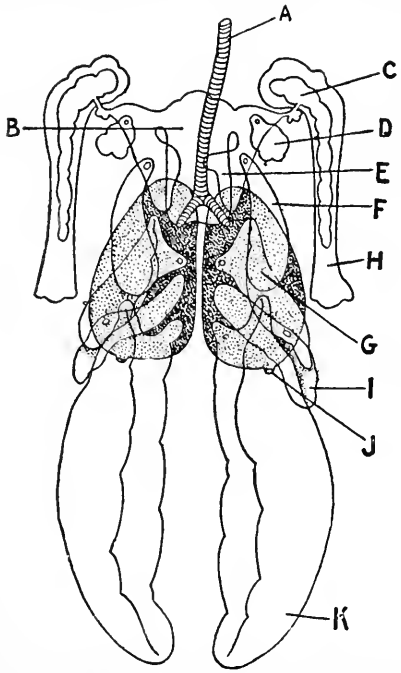

Fig. 9.—Diagrammatic representation of the air sacs showing their relation to each other, and to the lungs. A, trachea; B, interclavicular sac; C, D, E, F, extensions of the interclavicular sac; G, anterior thorocic sac; H, humerus; I, posterior thoracic sac; J, entrance of bronchial membrane; K, abdominal sac.

SYMPTOMS.—In the early stages of the disease no symptoms are noticed, and it is only after it has progressed considerably that these become apparent. The affected birds do not follow the flock; they are very weak, scarcely able to stand, and,

consequently, remain by themselves and move about very little. They remain in a recumbent position, resting upon the sternum, are sleepy, and, if forced to run, soon fall from exhaustion. The plumage is dull and rough, the wings are pendant, the eyelids partly closed, the head depressed. The respiration is accelerated and accompanied by a rattling or snoring sound, particularly during the expiration, and becomes difficult and labored, the bird opening its beak from time to time, in order to take a long inspiration. The temperature of the body is elevated, the thirst increased and the appetite is diminished or disappears. There is more or less catarrh of the trachea and bronchi, with emaciation and diarrhea leading to death from exhaustion in from one to eight weeks. When the disease is limited to the air-sacs of the interior of the body, emaciation may be the only symptom; but when it extends to the bones there may be lameness with swollen and painful joints.

In examining the birds after death, the seat of the disease may be found in the trachea, bronchi, lungs, the various air-sacs, and other internal organs. It is sometimes, though rarely, found in the nostrils and in the air-sacs of the interior of the bones. Two kinds of lesions are found. There may be tubercles resembling closely those of tuberculosis. These are whitish or yellowish nodules varying from the size of a pinhead to that of a pea. They may be isolated or joined together in masses of considerable proportions. These tubercles are generally found in the depth of the tissues, and even in the marrow of the bones. On the mucous membrane lining the air-tubes and air-sacs, the second form of disease process is seen. This consists of a membranous formation, an eighth of an inch

or more in thickness, which bears upon its surface a growth of the fungus. These membranous patches are at first soft, but become firmer with age, and are yellowish or greenish in color, resembling a fibrino-purulent exudate. They adhere closely to the mucous membrane which is there thickened and inflamed. The air-sacs are sometimes obstructed by these growths which may in time become caseous or even calcareous. These changes may also be seen in the intestines, the mesentery, the liver and in other organs.

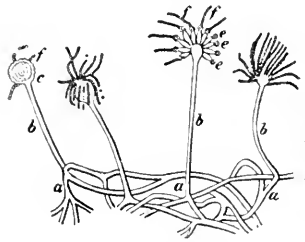

Fig. 10.—*Aspergillus glaucus*, *aa*, mycelium, *bb*, spore bearing stalks; *cc*, supports of the spores; *ff*, chains of spores; *gg*, bluish green spores.

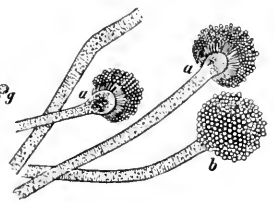

Fig. 11.—*Aspergillus fumigatus* with conidia bearers; *aa*, fruit heads in optical cross-section; *b*, fruit heads seen from above.

The membrane lining the air-passages may, also, be found ulcerated, and the ulcers may be either naked or covered with a growth of the fungus. There is often seen in the mouth of pigeons a whitish nodule, the size of a pea or larger, which is called a *canker*. This is believed by some authorities to be caused by the aspergillus.

In the very acute and rapid cases, the lungs may simply show inflammation, or there may be formation of pus or abscesses in the lungs, kidneys, liver and spleen as in pyæmia or septic infection. In some of

these cases there may be extensive hemorrhages, either locally or throughout the body, and these may constitute the only apparent alterations.

A microscopic examination reveals the spores or filaments of the fungus in most of the lesions, whether these are acute or chronic. The nature of the disease may consequently be determined by a *post-mortem* examination, but the diagnosis is uncertain and difficult during the life of the bird.

CAUSATION.—The various species of *Aspergilli* which cause this disease exist abundantly in nature and develop, particularly in some warm summers, upon all kinds of straw and grains. When musty straw or musty grain is thrown to the fowls the exciting cause of the disease is placed before them. As little care is exercised to remove this dust before straw is placed in the scratching-pens, or before grain is fed, vast numbers of the spores of these parasitic fungi are inhaled. This explains why the disease is generally found in the air-tubes, the lungs, and the air-sacs. Although many birds are exposed, but a comparatively small number are affected. These are probably more or less predisposed. It has been observed, in fact, that the delicate breeds, or the delicate and weak individuals, are most subject to the disease. Some authors are of the opinion that colds, irritation of the mucous membrane, or other forms of disease generally form the starting point of this mycosis. It is, also, probable that the number of spores taken into the air-tubes or digestive organs has great influence in determining the result.

PREVENTION.—As this disease is caused by the spores of pathogenic fungi which have developed upon

grain or straw, or similar substances, and as these spores must be inhaled with the breath or swallowed with the food, it is generally easy to guard against them. To accomplish this, avoid musty straw, or musty or moldy food. If grain or straw is very dusty remove this dust by appropriate means before it is put where fowls have access to it. Keep the houses clean, dry, and well ventilated in order to prevent the accumulation of such spores. Destroy by fire or deeply bury the carcasses of birds which die.

TREATMENT.—This disease when once established is usually fatal, notwithstanding medical treatment. Fumigation with tar vapor has been recommended. This is accomplished by shutting the fowls in a tight room, placing a tablespoonful of wood tar on a pint of water and stirring with a red-hot iron. The fowls are forced to breathe this vapor, which should not be so dense as to cause much irritation of the respiratory apparatus. The experiments of Lucet indicate that Fowler's solution of arsenic and particularly the tincture of iodine injected hypodermically have considerable influence in retarding the disease in rabbits. In the canker of pigeons, if other treatment fails, tincture of iodine may be applied to the affected part with a small brush or swab. In other forms of the disease in birds the internal administration of tincture of iodine or iodide of potassium should be tried. No form of treatment yet suggested, however, is very promising and the effort should be to prevent rather than to cure.

THE AIR-SAC MITE.

The peculiar arrangement of the respiratory organs in birds has led to the development of a form of para-

sitism which is not seen in our other domesticated animals. One of the mites has domiciled itself in the air-sacs of the gallinaceous birds, especially in poultry and pheasants, and is found at times in great numbers even in the abdominal sacs and in those which penetrate the bones. This mite, called the *Cytodites nudus*, is closely related to those mites which live upon the skin and cause mange or scabies. Indeed, when first discovered it was supposed by Gerlach to be one of the mange insects and to cause an internal form of that disease.

Careful study has shown that while the Cytodites is closely related to the mange acari, it differs from them in very important characters. The mouth parts in the mange mites are formed to cut and tear the flesh and enable the mite to burrow into the skin, or, at least, to puncture the skin and obtain blood or serum for its sustenance. In the air-sac mites the mouth parts are grown together and form a tube through which liquids may be sucked, but which is not adapted for tearing or puncturing the flesh. It would appear, therefore, that these mites can only produce a superficial irritation by their presence and movements upon the delicate surface of the mucous membranes, or possibly by depositing a virulent saliva such as is supposed to be the cause of a part of the

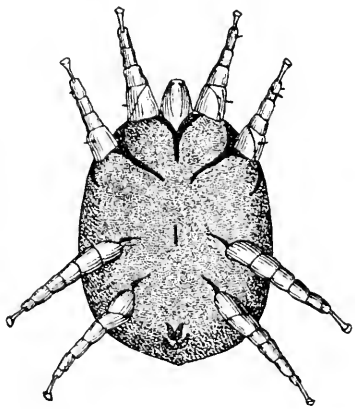

Fig. 12.—*Cytodites nudus*, male.

irritation of mange. Nevertheless, Holzendorff states that in addition to the infection of the air-sacs he has found in the lungs, liver, kidneys and other viscera, a great number of yellow miliary tubercles in which he also recognized this parasite.

When the air-sac mites exist in very small numbers, no signs of irritation or ill health are seen in the affected birds. When they become very numerous, however, they cause considerable irritation of the lining membrane of the air-sacs and they are crowded into the bronchi, where they set up inflammation, which may take the form of bronchitis or broncho-pneumonia. Megnin states that in such cases there may be obstruction of the air-passages causing fits of coughing and even sudden death from suffocation. Gerlach accused the Cytodites of causing enteritis (inflammation of the intestines), and Zundel thought they caused both enteritis and peritonitis (inflammation of the serous membrane lining the abdominal cavity). They probably cause anæmia, loss of flesh, and general unthriftiness, even if no form of acute disease develops.

This parasitic affection of the air-sacs is, of course, a contagious disease. The mites can not live for a very long time outside of the bird's body; they are brought upon a farm with affected birds and as opportunity offers they pass from bird to bird until the greater part or the whole of the flock becomes contaminated. No doubt the mites penetrate the body by crawling into the nostrils and following the trachea and bronchial tubes until they reach the air-sacs. How frequently, or under what circumstances they leave the air-sacs and seek the outside air is unknown.

Symptoms.— In many cases birds affected with the

air-sac mite show no symptoms of disease, and the existence of the parasite is only discovered accidentally when the carcass of a bird which has died from some other cause is being examined. In other cases the fowls are listless, inactive, with pale comb, and loss of flesh. Occasionally one dies without anyapparent cause. The acute cases may come on without premonitory symptoms. The affected birds are found quite ill, standing by themselves, with neck retracted, wings drooped, and labored breathing. There may be rattling of mucus in the throat as in bronchitis, or paroxysms of coughing. Death may come suddenly from obstruction of the air-tubes with plugs of mucus, or in other cases the illness may be prolonged and the birds die of exhaustion.

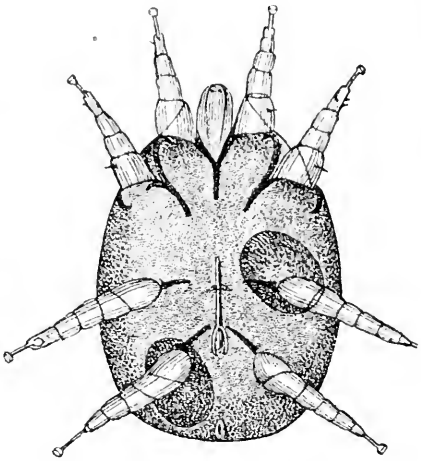

Fig. 13.—*Cytodites Nudus*, female.

The mites are readily discovered on the walls of the air-sacs after the death of the bird. They are about one-fiftieth of an inch in length and, therefore, easily seen with the naked eye. They are often so numerous that the surfaces of the air-sacs appear as though dusted with a whitish or yellowish powder. By careful watching, the points of which this powder is composed are seen to move and may be made out as the indivi-

dual acari. The mucous surface of the air-sacs may also be covered with yellowish points of exudate, the result of the irritation caused by the parasite, while the bronchi are congested and partly filled with mucus. In extreme cases there may also be pneumonia.

TREATMENT.— Megnin recommends giving sulphur mixed with the food and states that the small quantity volatilized and eliminated by the lungs is sufficient to kill the parasites. Others advise fumigation with the vapors of burning tar or the steam from boiling tar water. If this mite is discovered in the flock, efforts should be made to entirely eradicate it. No birds from an infected flock should be sold for breeding purposes. Feeding sulphur and fumigations may be tried, but the flock should be carefully watched, and if the parasite persists in spite of this treatment, it would be better to kill off all the birds, disinfect thoroughly and start with new birds from a flock known to be healthy. One of the best plans to secure a flock free from parasites of all kinds is to purchase eggs, hatch them in an incubator, raise the chicks in a clean brooder and put them on ground that has not been used for fowls for several years. There are so many parasites to which birds are subject, that may be avoided in this way, that we would recommend the plan to all who have discovered that their fowls are infested with parasites, or who for some mysterious reason have failed to make poultry thrive and yield satisfactory returns under ordinary conditions.

CHAPTER III.

Diseases of the Organs of Digestion.

GENERAL REMARKS CONCERNING THE DIGESTIVE ORGANS—OBSTRUCTION OF THE BEAK—INFLAMMATION OF THE MUCOUS MEMBRANE OF THE MOUTH, PIP, CATARRHAL STOMATITIS—THRUSH, APHTHÆ—DIPHTHERIA—PSOROSPERMOSIS—ASPERGILLOSIS—CROUPOUS ANGINA—OBSTRUCTION OF THE PHARYNX—CATARRH OR INFLAMMATION OF THE CROP—PARALYSIS OF THE CROP, IMPACTED CROP, OBSTRUCTED CROP—ABNORMAL APPETITE, ABERRATION OF THE APPETITE—CATARRH OF THE PROVENTRICULUS, INFLAMMATION OF THE STOMACH, GASTRITIS.

GENERAL REMARKS CONCERNING THE DIGESTIVE ORGANS.

IT IS necessary to know something of the form, structure, situation and use of the different organs which constitute the digestive apparatus in order to fully understand the diseases to which these organs are subject. Birds do not masticate their food as do mammals, but this is swallowed in the condition in which it is found, and, after passing along the upper part of the œsophagus, drops into the crop. The crop, or first stomach, Fig. 14–4, is a dilatation of the œsophagus; or we might call it a pouch attached to the front of this tube before it reaches the second stomach or succentric ventricle. It may be

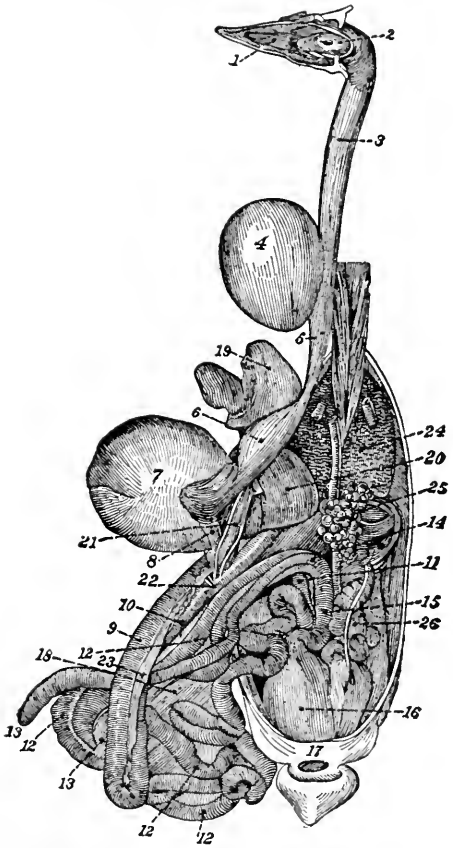

FIG. 14.—DIGESTIVE APPARATUS OF THE CHICKEN.

In this figure all of the head has been removed except the lower jaw, which has been turned sidewise to show the tongue and the openings to the trachea and œsophagus. The neck with the exception of the œsophagus, the breast bone, the heart and the superficial muscles have also been removed.

1, tongue; 2, pharynx, showing opening to larynx; 3, upper portion of œsophagus; 4, crop; 5, lower portion of œsophagus; 6, succentric ventricle; 7, gizzard; 8, origin of the duodenum; 9, first branch of duodenal flexure; 10, second branch of the same; 11, origin of the floating portion of small intestine; 12, small intestine; 13, free extremities of the cæca; 14, insertion of these two organs into the intestinal tube; 15, rectum; 16, cloaca; 17, anus; 18, mesentery; 19, left lobe of the liver; 20, right lobe; 21, gall bladder; 22, insertion of the pancreatic and biliary ducts; 23, pancreas; 24, lung; 25, ovary; 26, oviduct.

compared with the rumen or paunch of cattle and sheep. The food which is eaten and other substances which are swallowed drop first into the crop where they are macerated and softened in the liquids secreted by this organ. The contents of this crop are under normal conditions soon forced by the contractions of its muscular walls into the lower part of the œsophagus, which carries them on into the second or true stomach, the proventriculus or succentric ventricle, where they are mixed with the gastric juice and rapidly passed onward to the gizzard.

In the grain-eating birds, the gizzard is a remarkably firm, thick muscular organ which takes the food that has been softened and mixed with digestive liquids, and grinds it by pressing and rubbing it against pebbles that the bird has swallowed. Even the hardest grains and seeds are reduced in this manner to a paste upon which the digestive liquids can readily exert their dissolving action. This paste is pressed onward into the small intestine where it is mixed with the secretions of the liver, pancreas, and intestines, which complete the solution of the nutritive principles and render them proper for assimilation.

Under natural conditions birds are compelled to hunt their food, they find and eat but a small quantity at a time, and the crop, while designed by nature as a reservoir for storing food, is not overloaded by receiving a day's ration in a few minutes. In the domesticated state, these conditions are more or less changed, the birds are fed only once or twice a day and from lack of gravel, indigestion, and insufficient exercise, acquire abnormal appetites and eat feathers, straw, dry leaves and other indigestible substances. Diseases

and obstructions of the digestive tract occur from such causes, and while these are more or less preventable, even the most careful manager may occasionally find some of his birds affected. It is, therefore, advisable to study the form and functions of each organ so that the slightest variation from the normal working may be appreciated, and, also, that the proper change in management may suggest itself for the correction of such derangement.

OBSTRUCTION OF THE BEAK.

It is seldom that the upper part of the digestive tract of birds becomes obstructed. Megnin has, however, recorded the case of a bird in which a sunflower seed had become tightly wedged within the space formed by the branches of the lower mandible. This seed compressed and completely paralyzed the tongue, and as the bird was unable to dislodge it, the result was death from inanition. If the cause of the trouble had been recognized before the death of the bird, the offending body could have been easily removed with a toothpick or any pointed object and an immediate cure would have been thus affected. When a bird is seen to jerk its head suddenly as if to rid itself of something which adheres to the beak or head, particularly if there is difficulty of picking up and swallowing food, a careful examination should be made for some obstructing body such as a seed or a piece of bone. By raising the tongue, the angle of the lower mandible may be readily explored. No special directions are needed for the removal of such obstructions further than to use due care and to avoid as far as possible any injury to the sensitive tissues.

INFLAMMATION OF THE MUCOUS MEMBRANE OF THE MOUTH, PIP, CATARRHAL STOMATITIS.

A catarrhal inflammation of the mouth is seen in fowls and may be either an independent disease or a complication of certain inflammatory diseases of the respiratory organs. The term "pip" is commonly used with birds much as "hollow horn" and "murrain" are applied to cattle diseases; that is, it is made to cover a large part of the diseases to which birds are subject, and it is sometimes believed to exist by over-anxious poultry keepers when a careful examination shows that the birds are perfectly healthy.

Symptoms.— Inflammation of the mouth is a rare rather than a common disease. The symptoms consist of the drying of the membrane of the mouth and particularly of that covering the tongue. A hard opaque deposit accumulates along the edges and upon the under surface of the tongue, and may firmly attach this organ to the adjacent parts. The dried epidermis may partly separate from the sensitive tissues, and form a hard shell which remains attached to the free extremity of the tongue, causing more or less painful constriction and interfering with the movements of this important organ.

Cause.— This disease arises from any form of local irritation or injury which is sufficiently serious or long continued to set up inflammatory action. In the majority of cases it is probably caused by micro-organisms of feeble virulence which are able to make some headway when the digestive organs are deranged and the circulation of the parts somewhat disturbed. In most other cases, there is nothing more than a drying or desiccation of the mucous membrane caused by breath-

ing through the mouth on account of obstruction of the air passages, or disease of the lungs affecting the respiration.

TREATMENT.— The common treatment which consists of tearing the dried epithelium off the tongue, before it has entirely separated by the natural process, is cruel and injurious, often leading to the death of the bird. In case of simple drying of the mouth, it is sufficient to moisten the tongue with a few drops of a mixture of equal parts of glycerine and water. In case there is redness of the membrane, or if the epithelium is beginning to separate, or if a deposit has formed, add twenty grains of chlorate of potash to each ounce of this mixture. An excellent remedy for such cases is made by dissolving fifteen grains of boric acid in an ounce of water. Both of these solutions are harmless and may be freely and frequently applied. When the epithelium is separating, it should be kept moistened with the glycerine mixture and its detachment may be somewhat facilitated by loosening it with a pin or the point of a penknife, but great care should be exercised, the sensitive tissues should not be touched and no blood should be drawn. If properly treated the disease remains localized and is of slight importance. The exaggerated idea prevalent as to the dangerous character of "pip," probably arises from its being associated with serious diseases of the respiratory organs and from the fatal results which follow the forcible tearing away of the dried epithelium, leaving a bleeding and ulcerating surface. Should the drying and irritation of the membrane be the result of breathing through the mouth on account of disease of the air passages or lungs, the latter must, of course, be treated to effect a permanent cure.

THRUSH, APHTHÆ.

In human medicine the terms thrush and aphthæ are applied to an affection of the mucous membrane of the mouth, seen particularly in children, and which is characterized by the production of a white cheesy substance, composed of the filaments and spores of a vegetable parasite, called the *Oidium albicans* (or *Saccharomyces albicans*) and of the cells of the epithelium which have undergone extensive proliferation. Veterinarians have applied the name to several distinct diseases of the mouth, seen in various mammals and birds, which are characterized by a white or yellowish deposit on various parts of the mucous membrane lining that cavity. It is supposed that the term thrush has been applied to diphtheria and chicken pox in birds and possibly to other diseases. True thrush, although a rare disease, has been noted in at least two instances where a reliable diagnosis appears to have been made.

One of the two cases recorded in birds was described by Eberth as follows: At the autopsy of a very emaciated fowl, which had died after violent convulsions, there was found on the mucous membrane of the œsophagus, from the middle of that tube to the crop, several white but not extensive deposits firmly adhering to the surface. The internal surface of the crop was covered by a white layer, similar to the deposit of thrush. Below the crop, the œsophagus also had some more patches of a brownish-yellow color. The microscopic examination of this layer proved it to be composed of the spores and filaments of the *Saccharomyces albicans*. The second case, recorded by Martin, was observed in a young turkey. At the autopsy, there was found at the posterior part of the œsophagus and reaching as

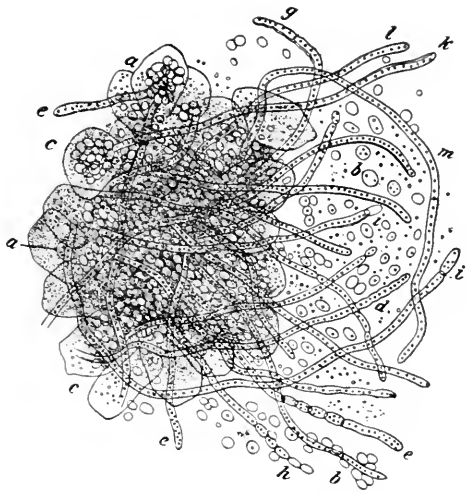

FIG. 15.—Microscopic elements of thrush: *a*, *a*, and *c*, *c*, epithelial cells; *b*, *b*, isolated spores of the *Saccharomyces albicans*; *d*, *d*, filaments of the mycelium; *e*, *g*, *l*, *k*, terminal portions of the mycelium; *h*, spores; *i*, ovoid terminal cell. Magnified 360 diameters.

far as the proventriculus, a layer of thrush having the same appearances to the naked eye and under the microscope as were described by Eberth.

Although, in the two recorded cases, the disease existed in the lower part of the œsophagus, it is very probable that it also occurs in the mouth of birds, a location favorable for its development with most species of animals. The disease does not appear to be very common, although it might be quite frequent and still not be recognized, as but comparatively few investigators have given systematic attention to poultry diseases. Thrush can be distinguished from other diseases causing a similar deposit only by a microscopic examination. The mycelium and spores of the fungus

are found in abundance between the epithelium and the mucous surface.

There are no characteristic symptoms in addition to the whitish patches upon the affected membrane. The patients are depressed, the mouth exhales an acid odor, the head may be swollen, the appetite is preserved, but there is rapid loss of weight and strength. Death is preceded by convulsions.

The canker of pigeons is believed by some investigators to be caused by this fungus.

TREATMENT.— The system of the bird should be strengthened by good food and tonics. The part affected should be treated with antiseptics and particularly with a ten per cent solution of borate of soda or with boric acid solution fifteen grains to the ounce of water. These solutions should be applied quite frequently in case the affected part is in the mouth, where it can be reached. When the disease is localized in the lower part of the œsophagus it can not be diagnosed during the life of the bird and hence can not be treated.

DIPHTHERIA.

Whitish, grayish, or yellowish patches of false membrane are frequently seen upon the mucous membrane of the mouth with various species of birds. This is generally due to diphtheria, a serious, contagious disease described in the chapter on generalized infectious diseases, to which the reader is referred.

PSOROSPERMOSIS.

Diphtheritic processes, pustules and ulcers of the mouth in poultry and pigeons have been attributed by numerous authors to psorosperms, or parasitic proto-

zoa. While such organisms have undoubtedly been discovered in connection with these lesions it is somewhat doubtful if their presence is more than accidental. The sore head, chicken pox, or pigeon pox, which invades the mouth, in certain cases, was long considered to be a form of psorospermosis. The most recent investigations, however, attribute this disease to a fungus of the group of *blastomycetes*. It is, also, stated that the tongues of poultry and pigeons may be invaded by psorosperms. These observations must be confirmed by use of the most recent methods of research before they can be accepted and before the disease, if any, which they cause can be described. The article on Chicken Pox or Sore Head in the chapter on Diseases of the Skin may be consulted in this connection.

ASPERGILLOSIS.

It has been shown by Dieulafoy, Chantemesse and Widal that young pigeons are frequently affected with a disease which appears in the form of a white nodule in the floor of the mouth. This is apparently caseous and in size varies from that of a pea to that of a small nut. It may be accompanied by miliary tubercles in the lungs which are either isolated or agglomerated in caseous masses. Similar tumors may be found in the œsophagus, intestine, liver and kidneys. These nodules which closely resemble those of tuberculosis do not contain the bacilli of tuberculosis but there is found in them the fungus known as the *Aspergillus fumigatus*. This fungus also, affects the mouth and air passages of poultry, and has been described in the chapter on Disease of the Organs of Respiration.

According to Dieulafoy, Chantemesse and Widal the "crammers of pigeons" are affected with a chronic

disease of the lungs probably caused by this fungus and due to contagion. In certain establishments in Paris, these men feed daily several thousands of pigeons, filling their mouths with a mixture of water and grains, then applying their own lips to the open bill of the birds in order to blow down a portion of this mixture. It is probable that they in this way become infected with the spores of the aspergillus from diseased pigeons. Culture and inoculation experiments made with the expectoration of the affected "crammers" confirm this explanation.

TREATMENT.— The appearance of this disease among poultry or pigeons should be at once accepted as a signal for thoroughly cleaning and disinfecting the houses and appurtenances liable to be infected. The diseased birds should also be isolated and treated or killed. Medical treatment to the nodules in the mouth has not been reported upon sufficiently to allow of an opinion being formed as to its efficacy. The remedies to be tried are boric acid solution fifteen grains to one ounce of water; sulphate of copper ten to fifteen grains to the ounce; carbolic acid in two per cent solution; flowers of sulphur to be applied in powder.

CROUPOUS ANGINA.

A form of croupous angina has been described by Rivolta and Delprato as affecting pullets and young pigeons, and which they believe to be caused by flagellate infusoria. They have named this organism the *Monocercomonas gallinæ*. This germ is a round or discoid body of a pale tint, and from 14 to 25 micromillimeters (1-2000 to 1-1000 of an inch) in length by 5 to 7 micromillimeters (1-5000 to 1-3500 of an inch)

in breadth. It has flagella at its extremities which enable it to move in any direction.

The symptoms are whitish points, spots or elevations upon the mucous membrane of the pharynx, œsophagus, crop, and more rarely upon the palate, base of the tongue and lingual canal. A microscopic examination of the affected spot shows it to be made up of epithelial cells, leucocytes, red blood globules, and granular matter, among which thousands of the infusoria are moving. Beneath the spot or patch, the mucous membrane is congested or inflamed.

This disease may cause death from loss of appetite and weakness. It is distinguished from diphtheria by the fact that the exudate is only slightly adherent to the mucous membrane and is easily detached from it. Some authors doubt if the infusoria cause the disease and are inclined to consider it a form of diphtheria. The treatment should be the same as recommended for diphtheria.

OBSTRUCTION OF THE PHARYNX.

Occasionally a bird attempts to swallow a particle of food, or a piece of green bone, so large or irregular in conformation that it becomes lodged in the pharynx. The condition may be recognized by the efforts of the bird to swallow the object or to rid itself of it; and by passing the fingers over the throat a hard swelling can be made out. Prompt relief should be afforded in such cases or death may result from suffocation. The treatment consists in the removal of the obstructing substance. This can generally be accomplished by carefully pressing on the sides of the throat in such a manner as to force the body into the mouth. If it is difficult to move it in this way, a teaspoonful of olive

oil poured into the back part of the mouth may assist in dislodging it. A small pair of forceps or any small blunt-pointed instrument may in certain cases be serviceable. Careful manipulation with the fingers may usually be relied upon, however, to accomplish the removal of the obstruction.

CATARRH OR INFLAMMATION OF THE CROP.

The mucous membrane lining the interior of the crop may be the seat of more or less irritation or even of inflammation. As a result of this process the functions of the organ are disturbed or arrested and serious conditions develop. The disease does not appear to be very common except as a complication of other disorders.

CAUSATION.— Catarrh of the crop may be caused by irregular feeding and by too much food being taken at one time. When the crop is over-distended the muscular coat is partially paralyzed, the secretion of the glands is interfered with, there is congestion of the internal coat, and fermentation or decomposition of the contents. If fowls eat feathers or other indigestible substances, these may irritate the mucous coat of the crop and produce catarrh. Partially decomposed meat, or putrid food of any kind, is also irritating and liable to produce the same result. The same disease occurs when birds eat substances containing phosphorus or arsenic, either by gaining access to rat poison, or when they are intentionally poisoned. Catarrh may, also, result from the presence of animal parasites (worms) such as the *Dispharagus nasutus* and *uncinatus* and the *Trichosoma contortum*. It is also a complication of thrush, diphtheria and cholera. With pigeons which have lost their young, it results from engorgement of

the follicles that secrete the milky liquid with which the young pigeons are fed.

SYMPTOMS.— The most prominent symptom is distention of the crop, and on examination the swelling is found to be soft and due to accumulated liquid or gas, mixed with more or less food. The birds are dull, indisposed to move, and there is belching of gas, loss of appetite and weakness. Sometimes there is nausea and the affected bird attempts to vomit. Pressure upon the crop causes the expulsion through the mouth of liquid and gas having an offensive odor due to fermentation.

TREATMENT.— A clean, dry pen should be provided for the affected bird or birds where proper attention can be given to the treatment and where the food can be regulated. The first step in treatment is to empty the crop of its irritating and decomposing contents by careful pressure and manipulation while the bird is held with its head downward. When the crop appears to be entirely freed of its contents, give two grains of subnitrate of bismuth and one-half grain of bicarbonate of soda in a teaspoonful of water. This will relieve the irritation and correct the acidity. Some authors recommend salicylic acid to be given immediately after the crop is emptied. It may be conveniently administered by dissolving one grain in an ounce of water and giving two to three teaspoonfuls as a dose. The bird should be kept without food for eighteen or twenty hours, and then fed sparingly upon soft, easily digested material. If one-half grain of quinine is given morning and night for two or three days the recovery is hastened. If treatment is commenced in time most of the birds will recover.

PARALYSIS OF THE CROP, IMPACTED CROP, OBSTRUCTED CROP.

The crop may be overloaded with dry grain, and its thin muscular walls distended, exhausted and paralyzed so that the organ can not be emptied; or, the opening into the lower portion of the œsophagus may be clogged with dry leaves, feathers, straw, and other indigestible substances swallowed by the bird; or, finally, the walls of the crop may be paralyzed in some diseases, as, for instance, in cholera and diphtheria, and, as the bird continues to eat, this receptacle becomes over-distended and packed solidly with food. In these different cases the symptoms are almost identical and the treatment must be conducted on the same principles. It is convenient, therefore, to group these different conditions together and consider them for practical purposes as constituting one disease.

CAUSATION.— Improper feeding is to a great extent responsible for impaction of the crop. Birds that are half starved or that have had no grain for a long time are liable to eat too much if they at once have access to a large quantity. Again, birds which have contracted catarrh of the crop from improper treatment frequently have depraved appetites and may fill the crop to repletion with food and all sorts of indigestible substances. It appears, therefore, that, with the exception of those cases of paralysis due to the poison developed in the course of the contagious diseases, and of those cases of obstruction resulting from the accidental swallowing of pins, nails, large pieces of dry bones, pieces of thread or cord and similar substances, this disease is caused by irregular or improper diet and a failure to maintain those hygienic conditions neces-

sary to good health. An insufficient supply of drinking water is, also, regarded as a cause.

Symptoms.— The affected bird has difficulty in swallowing or entirely loses its appetite. The crop is greatly distended, the swelling sometimes being of remarkable size. It is hard and more or less firm and unyielding on pressure. Sometimes a fermenting or decomposing liquid escapes from the mouth and nostrils. The bird is slow in its movements, dull, stupid, and sleepy. The comb is pale, the beak is kept open on account of the pressure on the trachea, and the feathers appear rough. In some instances sharp-pointed nails or other pointed objects are found to have penetrated the crop and skin and remain projecting from the puncture.

The pressure of the distended crop upon the windpipe and blood-vessels may cause asphyxia, the crop may become affected with gangrene, or it may even be ruptured. As much as three-fourths of a pound of moist or even sprouted grain has been removed from the crop in these severe cases.

Treatment.— The treatment of affected birds should be prompt and energetic to avoid the fatal complications which have been mentioned. Pour a small quantity of sweet oil into the mouth and cause the bird to swallow it. Then manipulate that portion of the crop nearest the throat by careful pressure and squeezing between the thumb and finger in such a manner as to break up the contents of the crop and force it towards the mouth in small portions. Suspend the bird head downwards from time to time and press the loosened particles of food towards the head so that they will escape from the mouth. With care and patience the crop may be entirely emptied in this way, if oil is ad-

ministered as often as is required to soften the contents. After this is accomplished give two grains of baking soda in water, keep without food for a day, and then feed sparingly on soft diet until recovery is complete.

In case the crop contains hard-pointed objects which can not safely be manipulated in the manner just described, or if such attempts at removing the impacted matter are for any reason unsuccessful, the crop must be cut into with a knife and the contents removed through the artificial opening. In order to perform this operation properly, the feathers should be clipped off with a pair of scissors over the most prominent part of the crop so that they will not obstruct the cutting or get in the operator's way when he is removing the contents of the crop. Now take a sharp, clean knife and make an incision through the skin and the wall of the crop until the food in this organ is reached. This opening should not be much over an inch in length, and should be rather high on the crop so that the food will not have the same tendency to press it open when healing as it would at the most dependant part. The contents of the crop should be carefully removed with the finger, or with the handle of a spoon or some other convenient object. The wound may now be washed with a solution of carbolic acid, five drops to one ounce of water, and closed with stitches. White silk is the best material to use for this purpose. Some stitch the walls of the crop first, allowing the ends of the silk to hang outside, so that after five or six days the thread may be cut and the stitches pulled out. The skin is drawn together in the same way. Other operators prefer to stitch through the skin and the walls of the crop at the same time, drawing them carefully and neatly together. In five or six days if

the union of the parts has taken place, cut the stitches and carefully draw them out so that they will not interfere with perfect healing. After the operation has been performed, give no food and only a small quantity of water, to which a grain or two of salicylic acid has been added, during the first twenty-four hours. Then feed with milk for two or three days, gradually changing to mush or more solid food, and finally return to the ordinary diet when the wound heals.

With fowls, this operation is not serious, if performed in time, the wound readily heals and the birds are soon well. With pigeons, it is usually fatal on account of the sensitive and vascular condition of the mucous membrane of the affected part.

ABNORMAL APPETITE, ABERRATION OF THE APPETITE.

Depraved and abnormal appetite is generally the result of some disease of the digestive organs, although, frequently, it may be an acquired habit. It often accompanies and is a symptom of catarrh of the crop, parasites of the œsophagus and crop, catarrh of the proventriculus, and partial obstruction of the gizzard from lack of grit. It is easily understood why these troubles should affect the appetite. The sensations of appetite and hunger are produced apparently by physiological variations of the circulation in the stomach, acting upon the nerves of this organ. Variations of the circulation occur from the diseases mentioned to a much greater degree than under physiological conditions, and, hence, the sensations produced are more acute and more urgent. They lead the birds to swallow the most convenient substances without much regard to their nutritive qualities or whether they can be

digested. Among the numerous substances which are swallowed under such conditions, are dry grass, leaves, particles of dry bone, pieces of cloth, nails, and feathers. Birds with such depraved appetites often pull the feathers out of other members of the flock, in order to satisfy their abnormal craving. In this way they acquire the habit of feather eating. Very often the feather-eating habit is acquired by imitation, and thus it may be introduced into a flock by a new bird which had contracted it elsewhere; or, it is spread through the flock from a bird which was led to it by indigestion, or other disease of the stomach. Lack of exercise may affect the digestion sufficiently to lead to feather eating.

TREATMENT.— Give the birds a good run in a grass-covered yard. Feed easily digested and cooling food including green vegetables. Onions are said to be particularly efficacious. If the yard is small, prepare a scratching shed, covering the floor deeply with straw, and scatter grain in the straw for the morning meal so that the fowls will be compelled to scratch and work to find it. Add bicarbonate of soda to the drinking water in the proportion of about twenty grains to the quart and put a small quantity of salt in the food. Salting of food should, however, be light as large quantities of salt are injurious and may be fatal to poultry.

CATARRH OF THE PROVENTRICULUS, INFLAMMATION OF THE STOMACH, GASTRITIS.

The true stomach or proventriculus of the fowl is a comparatively small organ. It has the appearance of a dilatation of the œsophagus below the crop and just in front of the gizzard. The capacity of the proventri-

culus is slight, and with those birds which live upon vegetable substances the food is fed to it gradually and almost constantly from the crop. Birds which eat insects, fruits, or flesh exclusively have either no crop or only a simple dilatation of the œsophagus, as such food is easily digested.

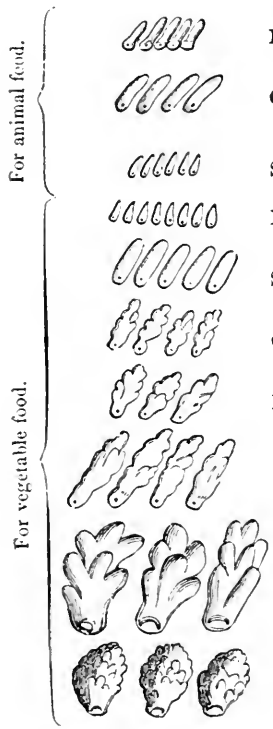

FIG. 16.—Gastric glands of birds.

In the walls of the proventriculus are the gastric glands which secrete the gastric juice required for the digestion of the albuminoid constituents of the food. The different forms assumed by the gastric glands in various species of birds are illustrated in Fig. 16. The simplicity or complication of these glands indicates to a certain extent the kind of food which is natural to the species. The gastric juice may digest flesh, fish, and ground feed while still in the proventriculus, but it can not act upon grains and seeds until these have been crushed in the gizzard. Catarrh or inflammation of the mucous membrane of the stomach is a not uncommon disease, and one which seriously interferes with the vigor and

productiveness of the flock and may cause considerable losses as it often ends fatally.

CAUSATION.— Gastritis may be caused by anything which interferes with the proper digestion of the food. A lack of grit may prevent the gizzard from triturating the food with sufficient rapidity, the passage is, therefore, blocked, the aliments are held back in the stomach, the latter is unduly distended, and the contents, being retained too long, cause irritation. The ingestion of too large a quantity of food may act in the same way. It is said that a long-continued ration of stimulating food, too much condiments or condition powder, and lack of exercise are all exciting causes; as are, also, impure drinking water, mouldy food, and putrefying flesh. In certain cases this disease is produced by irritating poisons, such as rat poison, phosphorus from matches, and similar substances obtained accidentally or given maliciously. Occasionally it is found to be due to pins, nails, pieces of bone or other sharp objects which have become lodged and may have partly or completely penetrated the walls of the organ. It may be observed as a complication of various contagious diseases, such as fowl cholera and diphtheria.

SYMPTOMS.— With inflammation of the stomach, there is loss of appetite and marked thirst. The birds are dull and have some fever, with accelerated breathing. The plumage is erect, the wings drooping, and there is usually constipation. In serious cases there is great prostration and indisposition to move, loss of flesh is rapid, and the strength is soon exhausted.

TREATMENT.— If the disease is identified in its early stages, seek for its cause, and endeavor to overcome it by removing the cause. Change the ration and give more easily digested food, with some meat.

Feed regularly, often, and a small quantity at a time. Give some cooked food, with barley water or milk for drink, or put twenty grains of bicarbonate of soda to a quart of drinking water. In severe cases, give two grains sub-nitrate of bismuth three times a day in a teaspoonful of water. Counteract constipation with Epsom salts (twenty grains) or castor oil (one teaspoonful) once a day as long as may be necessary. Let the fowls run on young grass with plenty of range. In case the disease is due to poisoning or to sharp objects imbedded in the stomach, it generally ends fatally before its nature is discovered.

CHAPTER IV.

DISEASES OF THE ORGANS OF DIGESTION (*continued*).

GASTRO-INTESTINAL CATARRH, SIMPLE DIARRHEA, GASTRO-ENTERITIS, ENTERITIS—CONSTIPATION, INTESTINAL OBSTRUCTION—TOXIC GASTRO-ENTERITIS—BACTERIAL ENTERITIS—ASTHENIA, GOING LIGHT—PSOROSPERMIC-ENTERITIS—INFECTIOUS ENTERO-HEPATITIS OF TURKEYS, BLACK HEAD—PARASITIC WORMS WHICH INFEST THE DIGESTIVE APPARATUS—THE NODULAR TÆNIASIS OF FOWLS.

GASTRO-INTESTINAL CATARRH, SIMPLE DIARRHEA, GASTRO-ENTERITIS, ENTERITIS.

THE conditions known as gastro-intestinal catarrh and gastro-enteritis may be regarded as different degrees of the same process, or as the same disease but much more intense in one case than the other. The stomach and intestine are both affected. With enteritis the inflammatory process is confined to the intestine. During the life of the bird it is somewhat difficult to make a distinction between these three conditions and it is, therefore, more convenient from a practical point of view to group them together. By *postmortem* examination, it is seen that the catarrhal process produces comparatively slight changes in the walls of digestive organs and that these are superficial and near the epithelial surface, while in gastritis and enteritis there is more redness and thickening, and the inflammation extends not only to the deeper layers of the mucous membrane but to the other coats of the stomach and intestine.

CAUSATION.— The cause of simple inflammation of the digestive tract is to be sought either in the quantity of the food, the quality of the food or of the drinking water, or the atmospheric conditions to which the bird has been exposed. This form of inflammation should not be confounded with that which is caused by irritating poisons, or by the various kinds of parasites which are liable to develop in the digestive tube.

Inflammation of the stomach and intestines may result from overloading the stomach; from too stimulating rations or from too much pepper, condiments or condition powers; from eating tainted, moldy or putrefying food; from drinking water which has been contaminated with filth and which has stood in a warm place or in the sunshine until it has become putrid; from exposure to draughts, cold rains or damp coops, particularly during the molting season. It most frequently affects young birds and the improved breeds.

SYMPTOMS.— There is loss of appetite, roughness of the plumage, depression and indisposition to move. The crop is generally distended, its walls are partially paralyzed and it empties slowly; in some cases it may contain no food. There is frequent expulsion of soft, whitish, yellowish or greenish excrement, which is irritating to the cloaca and to the neighboring parts. The droppings gradually become more liquid until a severe diarrhea sets in. The expulsion of the excrement may be accompanied by a spasmodic and painful contraction of the bowels which causes the bird to strain or to stop suddenly when walking. The mucous membrane of the cloaca becomes inflamed, and the feathers surrounding it are stuck or glued together. There is increased thirst, elevation of temperature,

hemorrhages from the intestines may occur, and the progressive weakness and exhaustion soon end in death. In the mild cases of gastro-intestinal catarrh there may be no symptoms other than those of diarrhea, but in the more severe cases of this disease and in gastro-enteritis and enteritis the greater part or all of the symptoms mentioned above are observed.

TREATMENT.— In the treatment of this class of diseases it is especially important that the cause should be sought and removed. See that the birds are comfortable and not exposed to draughts, cold, or dampness. Give pure drinking water and regulate the food. Allow small quantities of mash or cooked food, with some chopped beef. Put a handful of oatmeal in the drinking water or give milk for drink. Give a tablespoonful of olive oil as a laxative to carry off any irritating matters that may be in the intestine, then follow with ½ to 1 grain of bicarbonate of soda and 2 grains of subnitrate of bismuth in a little water three times a day. In cases where the diarrhea becomes serious, with symptoms of pain, fever, or bloody discharges, omit the bicarbonate of soda and give ⅛ grain powdered opium and 2 grains subnitrate of bismuth every four hours. If the diarrhea persists after the fever has disappeared and the appetite is returning, it may be checked with laudanum 5 to 10 drops; or give 10 drops of a mixture of equal parts laudanum and tincture of catechu; or in mild cases add one to two drams of sulphate of iron to the pint of drinking water.

CONSTIPATION, INTESTINAL OBSTRUCTION.

Constipation is due to an abnormal dryness and hardness of the contents of the intestines, which leads to the accumulation of the contained substances, and

the consequent distention and obstruction of the intestinal passage. It is sometimes caused by dry, astringent food; in other cases it results from some irritation of the mucous membranes; it may be due to the unnatural dryness of the intestine, which often occurs after attacks of diarrhea. The intestine may also be obstructed by masses of gravel and by quantities of parasitic worms. These obstructions may be found in any part of the intestinal tract. Frequently, obstruction occurs at the lower end of the intestine near the external opening. This is caused either by irritation of the cloaca or by the drying of excrement upon the feathers about the anus, and its continued collection until the expulsion of the intestinal contents can no longer be accomplished. In all of these cases there necessarily follows a great accumulation of matter in the intestine above the obstructed point, the moisture is absorbed from this, it becomes dry and hard, irritation and inflammation are produced sooner or later and the life of the bird is seriously threatened.

Symptoms.— Birds which are affected with serious constipation or intestinal obstruction become dull, lose their appetite, stand with arched back, roughened plumage, walk with more or less difficulty, are at times uneasy and make frequent attempts to expel the excrement. By careful examination, the hard impacted intestine may often be felt through the abdominal walls or the obstruction of the cloaca may be discovered. Frequently, the dried mass of excrement may be seen adhering to the feathers and blocking the external opening of the bowels.

Treatment.— When the obstruction has commenced and is maintained by accumulations of the excre-

ment upon the feathers, the first step is to get rid of this obstructing mass. It should be soaked in warm water until softened, and then by clipping some of the feathers about the vent it is easily removed. If the cloaca is filled with a hardened mass, this too should be softened with warm water or with olive oil, and carefully manipulated until it can be pressed out or otherwise removed without injury to the bird. Oil may be inserted around such an obstruction with a small syringe, or, in the absence of a syringe, an oil can, such as is used for oiling machinery, answers the purpose very well. After the oil has been applied freely, it may be necessary to wait an hour or two for it to penetrate and soften the obstruction before much progress can be made towards its removal by manipulation. The handle of a small spoon or a similar blunt instrument is often of assistance in clearing out the contents of the cloaca.

When there is serious constipation or when obstruction has taken place higher up in the intestine where it can not be reached by external applications, laxative or purgative medicines are necessary. The most successful of these are Epsom salts twenty to thirty grains dissolved in a tablespoonful of water; castor oil one to two teaspoonfuls; or calomel one to two grains made into pills with butter or lard. The constipation should also be corrected as far as possible by regulating the rations of the birds. Give soft, watery mashes, green feed and bran until the bowels appear to be once more in a normal condition. The skillful feeder will generally prevent both diarrhea and constipation by careful attention to the diet.

TOXIC GASTRO-ENTERITIS.

Acute inflammation of the intestinal tract is frequent-

ly seen in poultry as a result of taking irritant poisons into the stomach. The symptoms are inflammation of the mouth, diarrhea, trembling, convulsions, prostration and drowsiness. The affected bird seeks a dark and quiet place and is found with roughened plumage, the head drawn down to the body, and is usually in a sleeping or comatose condition. Unfortunately, the poisoning is not usually discovered until too late for successful treatment.

The general treatment is the same as for simple gastro-enteritis, and with some poisons antidotes may be administered, though in most cases treatment is without avail. The most common poisons to which poultry gain access are the following:

Chloride of sodium or *common salt*, *concentrated lye*, and *nitrate of soda*. Common salt is obtained generally from brine when pork, beef or fish barrels are emptied, or from eating salt meat. Concentrated lye is often carelessly left about the premises where birds can reach it. Nitrate of soda being frequently used as a fertilizer is one of the most accessible poisons. Treatment should consist of abundant mucilaginous drinks such as infusion of flaxseed, together with stimulants, strong coffee and brandy being particularly useful.

Arsenic, *lead*, *copper*, *zinc* and *phosphorus* may cause accidental poisoning with poultry. Arsenic in the form of Paris green, London purple, etc., is commonly used on the farm for poisoning insects; lead and zinc are used in paints; copper is used to destroy fungi on grain, fruit trees, vines, and plants; and phosphorus exists on the heads of matches. Treatment of arsenical poisoning should be with sulphate of iron and calcined magnesia, white of egg, and flaxseed mucilage. For lead, copper, zinc and phosphorus give large quanti-

ties of white of egg, mucilage and sugar water. Eulenberg recommends charcoal pills for phosphorus poisoning, or sulphate of copper may be given to cause formation of insoluble phosphate of copper. Sulphates of soda, potash, or magnesia may be given in lead poisoning with the object of forming insoluble sulphate of lead.

Among the vegetable poisons *ergot of rye* is one of the most common. It causes trembling, vertigo, intoxication, coma, great weakness, and gangrene of the comb, beak, tongue or limbs. As treatment give stimulants as coffee, brandy, camphor, and quinine.

BACTERIAL ENTERITIS.

Inflammation of the mucous surface of the intestines due to the multiplication of irritating bacteria must be classed among the most common and most injurious diseases of fowls. This disease occurs in chickens, turkeys, ducks and probably most other kinds of birds and is frequently mistaken for cholera. It is caused by several distinct varieties of bacteria, and may be either acute or chronic in its form.

CAUSATION.—The principal germs which have been studied in connection with outbreaks of enteritis in birds are:

1. The *bacillus gallinarum* (Klein, Lucet), a short bacillus found in great numbers in the intestines of affected birds, and, also, in the blood. The disease may be produced in chickens and turkeys by inoculating this germ beneath the skin. If the germs are fed with ordinary food they do not cause disease, but if fed with animal food the disease may be produced. Fowls die in about five days after inoculation. Infection occurs from contaminated food or drinking

water. The bacillus does not remain localized in the intestine but may be found in the liver, kidneys and blood of birds which have succumbed to the disease. Pigeons are insusceptible.

2. The bacilli described by Cornil and Toupet are short rods found in outbreaks of this disease among ducks. They are found in the intestines, heart, liver, spleen and blood. The disease may be transmitted to ducks by inoculation or feeding with the germs. Chickens and pigeons are not affected by it.

3. The *Vibrio Metchnikovi*, also called the *Spirillum Metchnikovi*, is a spiral-shaped germ resembling the comma-bacillus. Chickens are very susceptible to these germs, and whether they are introduced by the air-passages or digestive organs, or inoculated beneath the skin, they find their way to the intestines and cause inflammation with the symptoms of cholera. Pigeons may be infected by inoculation, but do not suffer from this germ when it is fed to them. It is seen from this brief summary that bacterial enteritis affects principally turkeys, ducks and barnyard fowls. The outbreaks of this disease are usually confined to a single farm, they generally begin early in summer, are at first acute and very fatal in their effects, but gradually diminish in intensity until they finally disappear. Birds of all ages are affected, though the younger ones are apparently more susceptible.

Symptoms.— In the acute form the symptoms develop rapidly. The affected birds are dull, listless, and indisposed to move. They have considerable thirst, but are without appetite. The comb becomes pale, the excrements at first solid and of a greenish color, later are soft, liquid, abundant and bluish green. As the disease advances, the sick birds stand with the

back rounded, the plumage erect, the wings drooping, the head drawn down to the body, and the eyes closed. They gape frequently, their walk is slow, hesitating and unsteady. The diarrhea persists, the excrements are colored with blood, the strength is rapidly lost, and walking becomes more and more difficult. In the later stages of the disease, the bird sleeps most of the time and can scarcely be aroused, a viscid, grayish liquid escapes from the mouth, its comb becomes purple, and it finally falls upon its side and dies after a few struggles.

In the early stages of the disease the temperature is elevated two degrees to four degrees F., but later drops three degrees to five degrees F. below normal. The birds die in from one to two weeks after they are attacked. The chronic form of the disease is characterized by slower development and less marked symptoms. The birds are sick three or four weeks before they die. Their appetite is capricious, the feathers are rough and have lost their lustre, the comb and flesh are pale and bloodless, and there is an exhausting diarrhea. If the birds are handled the owner is surprised at the great loss in weight, as the flesh appears to have almost disappeared. This loss of strength and flesh continues until the bird dies from exhaustion. In some cases temporary improvement is seen; the diarrhea disappears; the comb partially regains its colors; the bird appears stronger; but suddenly there comes a relapse, the symptoms are intensified, and death follows in a day or two. In a few cases the improvement is permanent, and the affected birds finally recover their health and flesh.

In examining the carcasses of the dead birds, the liver is found greatly enlarged and distended with

blood, and if a cut is made into it considerable blood escapes. The spleen is also enlarged, but pale; the intestines and particularly the cæca are red and contain considerable mucus. In the chronic form of the disease the liver may be found smaller than in health.

The disease is distinguished from the cholera by its longer duration, the tendency to the chronic form, by its limitation to a single premises and by the fact that it is not transmitted to rabbits by inoculation. It is very destructive and from fifty to eighty per cent of the fowls on a farm may die before the disease disappears.

TREATMENT.—To prevent outbreaks of bacterial enteritis cleanliness should be enforced about the poultry buildings, and the birds should be allowed only pure and clean drinking water and food that is not undergoing putrefaction. When fowls are compelled to slake their thirst by drinking the foul water of stagnant ponds, or the seepage from the barn yard, or when they are fed with rotten grain or vegetables or with putrid meat, this disease is liable to develop. It is, therefore, important to avoid this exciting cause of the malady. The trouble may also be introduced with sick fowls that are brought upon the place, and, hence, the necessity of isolating or quarantining all new arrivals until their perfect health is assured. By such a precaution not only this disease but all other forms of contagion may in many cases be avoided.

After the disease has broken out among the poultry on a farm, the first effort for its eradication should be a general cleaning up and disinfection. The disinfectant may be a five per cent solution of carbolic acid for saturating the floor and woodwork of the buildings, followed by a thorough application of lime wash.

The drinking vessels and feeding troughs should be well scalded with boiling water. This cleaning and disinfection should be frequently repeated until the disease disappears. The medical treatment of the birds has three objects in view: 1. To disinfect the intestinal passage 2. To arrest the diarrhea. 3. To renew the strength. A good treatment is to give sub-nitrate of bismuth three grains, powdered cinnamon or cloves one grain, powdered willow charcoal three grains. This may be given twice a day mixed with the food or made into pills with flour and water. If not successful with the formula just given try sub-nitrate of bismuth three grains, bicarbonate of soda one grain, powdered cinchona bark two grains, mix and give three times a day in a paste made with rice flour. When the diarrhea is arrested the bismuth and soda are no longer indicated, but a tonic is still advisable. For this Megnin recommends: Powdered fennel, anis, coriander and cinchona of each thirty grains, powdered gentian and ginger of each one dram, powdered sulphate of iron fifteen grains. This is thoroughly mixed and may be given in the feed so that each fowl will receive from two to four grains twice a day.

As intestinal disinfectants are especially indicated in this disease, naphthol, benzonaphthol, betol and salicylate of bismuth have been tried and are highly recommended. The dose of each of these drugs is from ½ to 1 grain for a full-grown fowl. The following combinations will be found useful: Betol ½ grain, subnitrate of bismuth 1 grain, powdered opium ⅛ grain. Mix and make into pellets with a little syrup. Give at one dose every four hours. Or, benzonaphthol and salicylate of bismuth of each ½ grain, Dover's powder ¼ grain.

The food of affected birds should be nutritious, easily digested, and not too wet. Middlings and meal, rice flour or dry bread may be mixed with boiled milk into a stiff paste and fed either alone or with the addition of boiled and finely-chopped beef or hard-boiled egg. The ration should be light until the diarrhea is checked and other symptoms of improvement are seen.

ASTHENIA, GOING LIGHT.

A disease in fowls in which the most noticeable departure from the normal condition was their extreme emaciation has been investigated by Dr. Dawson of the Bureau of Animal Industry. The appetites of the affected birds were voracious, there was no evidence of existing diarrhea, but on the contrary slight constipation. The disease was chronic, ending in death in about three months. There was no increase in temperature. The comb and wattles were paler than usual. There were 350 fowls on the premises 30 of which had died and 100 were sick at the time of the investigation. The diet consisted of a morning meal of mash made of six parts bran, four parts of middlings, and two parts of meat meal with condition powder and charcoal. They had plenty of small gravel and crushed oyster shells. At night, wheat, corn and oats were fed. Adult Brahma fowls seemed most susceptible. The disease makes itself known through loss of flesh and was, therefore, called "going light." The symptoms appeared to be aggravated by damp weather. The disease did not exist, so far as could be ascertained, upon any of the neighboring premises.

Examination after death reveals extreme emaciation of the muscular system and almost complete absence of fat. The walls of the duodenum were reddened and

there was catarrh of the mucous surface. A peculiar bacterium was found in the duodenal contents. A guinea pig was inoculated subcutaneously with a small quantity of material from the duodenum and died in the course of twenty-four hours with an extremely œdematous and necrotic condition of the tissues over the abdomen. The germ was found in the tissues at the point inoculated and, also, in the liver, spleen, abdominal exudate, heart-blood and lungs. Rabbits were inoculated and fed with cultures of the organism without result, except when half a cubic centimeter was injected into the abdomen, in which case death followed within twenty-four hours. In the rabbits treated in this way, there was severe inflammation of the duodenum and omentum, and the germ was recovered in large numbers from the walls and contents of the duodenum and from the liver. Chickens were inoculated subcutaneously, into the abdomen and into the veins, and were also fed upon cultures without causing disease in them. Pigeons, mice and rats were refactory.

The presence of this germ in the diseased intestines of the fowls and its pronounced disease-producing powers when inoculated in guinea pigs and rabbits warrants the suspicion that it is the cause of the duodenitis and emaciation of the fowls. It is probably necessary for it to reach the interior of the duodenum before it can cause disease in birds. This germ differs materially from the microbes of bacterial enteritis described by other investigators, but the diseases are of a similar nature and the treatment should be the same.

PSOROSPERMIC ENTERITIS.

This is a disease caused by the lowest forms of ani-

mal parasites, viz., the protozoa. The varieties of protozoa which cause enteritis are generally spoken of as *psorosperms* and the disease which they produce is known as *psorospermosis* or *psorospermic enteritis*. There are two species of psorosperms which have been found to produce inflammation in the intestines of fowls: The *Eimeria dubia* (*Gregarina avium intestinalis*) and the *Coccidium tenellum*. As the symptoms, the appearance of the intestines, and the treatment varies considerably from bacterial enteritis, it is necessary to devote a special article to the psorospermic form.

CAUSATION.—These parasites, probably in the condition of spores, are taken into the digestive tube with the food or drink. They multiply along the course of the intestine, penetrate the mucous membrane, produce irritation and set up a series of changes in the tissues which very seriously affect the functions of the invaded organs.

The *Eimeria dubia* mutiplies also in the connective tissue beneath the mucous membrane, forming small cysts, seen as whitish points, which are found filled with its spores. The inflammation may extend even to the peritoneal coat of the intestine, thus producing a complication of peritonitis with enteritis. The lesions resemble, more or less, those of diphtheria and tuberculosis, and as the liver and lungs are often invaded we can understand why the disease has been called *tuberculo-diphtheria* by Megnin, Cornil and others.

The *Coccidium tenellum* is generally found localized in the cæca. It multiplies in the mucous membrane, producing whitish patches, denuded surfaces, and ulcers, and causes a very intense inflammation.

SYMPTOMS.— When only a small number of the nodules of the *Eimeria dubia* exist in the intestine of a fowl, no symptoms of disease are seen and the bird does not appear to suffer. When, however, the lesions are more numerous, and particularly when the germs are multiplying on the mucous surface, considerable inflammation results, the processes of digestion and assimilation are interfered with and death may result. The principal symptoms are depression, loss of appetite, diarrhea, weakness, and rapid loss of weight.

The *Coccidium tenellum* produces a more acute, and rapidly fatal disease. There is progressive weakness, stupor, loss of appetite, difficulty of walking, diarrhea, sometimes constipation, plaintive cries and death in a few days. With young chicks there is diarrhea with whitish excrement followed by constipation. With adult fowls the diarrhea is abundant and the excrement may be of a brick-red color or even streaked with blood. It is very destructive to young chickens, frequently a whole brood dies of it, and it may destroy the greater part of those which the possessor of infected premises attempts to raise. An examination of the cæca generally shows active inflammation, though with the chicks which showed constipation the organs named were found of a normal color, but distended with a hard, yellowish exudate containing many of the parasites.

TREATMENT.— Preventive treatment is the most satisfactory. Disinfect the houses and runs with strong carbolic acid solution (three to five per cent), and scald out the feeding troughs and drinking vessels with boiling water. If possible, change the birds to fresh ground that has never been infected.

As medical treatment, hyposulphite of soda five

grains, quinine (sulphate) one grain, subnitrate of bismuth two grains may be given two or three times a day to grown birds, and less, in proportion to the size, to the young chickens. A mixture of equal parts of powdered fennel, anis, corriander, gentian, ginger, and aloes has been recommended and may be given in the dose of about five grains for adults, mixed with soft feed.

The chief reliance in combating this disease should be placed in the efforts to eradicate the contagion. If disinfection and change of ground are not successful, dispose of all fowls for a time, plough up the ground, clean up thoroughly and start with new stock, preferably incubator chickens, from healthy flocks.

INFECTIOUS ENTERO-HEPATITIS OF TURKEYS—BLACK HEAD.

For ten years or more, reports from certain sections of the New England States have indicated the existence of a serious disease of turkeys, locally called "black head," which differs in important respects from any malady previously known as affecting poultry. How widely this disease is distributed over the world is not yet determined, but information from the Middle, Western and Southern States points to its prevalence in those sections, and accounts have also come to hand of its ravages in Europe. From these facts it may be concluded that the disease is one which has been affecting turkeys for many years and has been extensively disseminated, and that, owing to the lack of systematic investigation, it was not described until its study was undertaken by the U. S. Bureau of Animal Industry. Considerable time was devoted to this subject by Smith in 1893 and 1894, and by Moore in 1895 and 1896.

Symptoms.—The symptoms of infectious entero-hepatitis have not been very carefully observed and recorded. It is not until the disease has made considerable progress that any signs of ill-health can be detected. The affected birds show more or less loss of appetite, weakness and emaciation, though one or more of these symptoms may not be constant.

Fig. 17.—Cæca of healthy turkey.

Diarrhea is the most marked and constant symptom and may be expected sooner or later in the course of the disease. It results from the inflammation in the cæca, which is the starting point of the affection, and this inflammation exists in all cases. Peculiar discolorations of the head occur at the height of the disease, which have led to the popular designation of "black head," but Smith is of the opinion that these are not constant and that they may accompany other conditions.

The disease attacks quite young turkeys, having been recognized in a bird only three weeks old, and in this it had already made considerable progress. The young birds seem to be most susceptible, and, as in the older birds the organs have the appearance of long standing disease, the conclusion has been reached that the infection usually occurs at an early period of life. The infection is most actively propagated during mid-summer, but whether this is due to the fact that there are more young birds at that

time, or whether the warm season favors the dissemination and the development of the disease is not clear. That infection may occur in older birds and in cold weather is demonstrated by Moore's experiments in which turkeys five months old and weighing six to eight pounds were exposed in November and December, and in which the disease was well developed by the latter part of December and the early part of January.

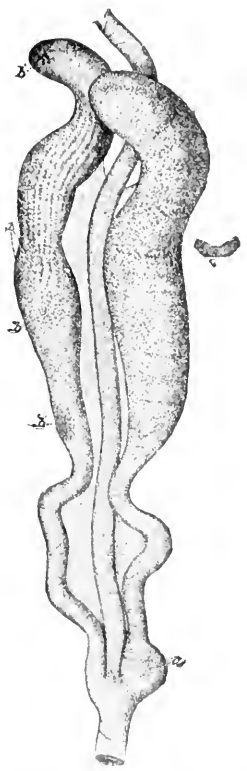

Fig. 18.—Cæca of diseased turkey.

The disease begins in the cæca; sometimes it is found in but one of these organs but oftener it affects both. With the progress of the disease, the mucous membrane may be shed and a coagulable fluid poured out into the cæcum. In some cases this exudate appears as isolated masses, which adhere to certain spots of the mucous membrane; in others, it fills the entire tube with a yellowish-white mass or plug, built up of concentric layers and consisting of a mixture of blood corpuscles, fibrin and round cells. The wall of the affected cæcum is thickened, and the inflammation may extend to the outer or serous coat upon which yellowish exudates are sometimes seen that may bind the organ to the other cæcum, to other parts of the intestine or to the abdominal wall. In no case

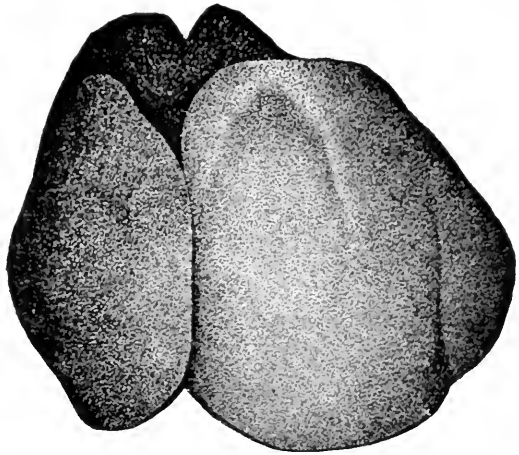

Fig. 19.—Liver of healthy turkey.

were other regions of the digestive tract found affected.

Associated with this disease of the cæca, there is in nearly all cases a more or less serious disease of the liver. This organ is enlarged in proportion to the amount of its tissue which is affected. It may be twice the normal size, and over its surface are seen roundish discolored spots, varying from one-eighth to two-thirds of an inch in diameter. Some of these spots are sharply defined circular areas of a lemon yellow or an ochre yellow color. This yellow substance represents dead tissue. In other cases the spots are whitish and shade off somewhat gradually into the surrounding tissue. Another class of spots are of a mottled brownish color, darker than the surrounding liver tissue. These may have a central yellow nucleus of dead tissue, and a narrow outer border of the same character, or the border may be a dark brownish circular line. The entire spot has an indistinct appear-

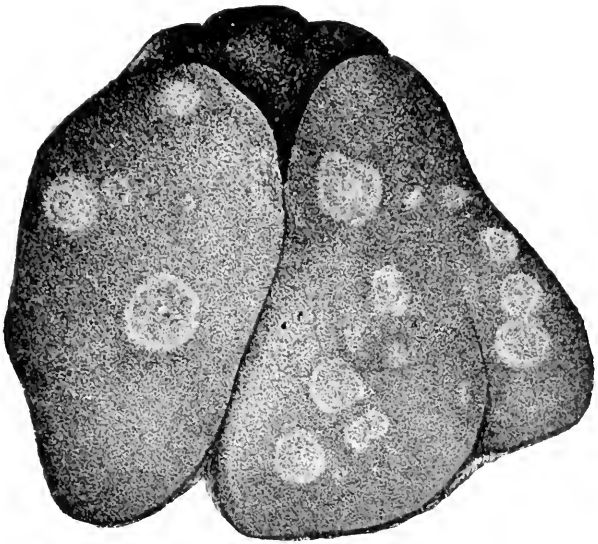

Fig. 20.—Liver of diseased turkey.

ance and is flattened or even slightly depressed below the surface. The liver may have few or many of these centers of disease, which when cut across are found to be deeply imbedded in the tissue of the organ and to have in general a spherical form. Occasionally the lesions are very extensive and the death of large portions of the liver tissue follows.

CAUSATION.— The disease is caused by one of the protozoa, which Smith has named the *Amœba meleagridis*. This parasite is taken into the digestive organs with the food or drink, it attacks the mucous membrane of the cæca, causing the development of inflammation and leading to the changes already described. The affection of the cæcum is due primarily to the multiplication of the micro-organism, which takes

place chiefly in the mucous membrane or the sub-mucous tissue, or it may, though rarely, extend into the muscular coat. According to Smith, the parasites do not invade the epithelium at any time.

The changes in the liver are most easily explained by assuming that the micro-parasites are conveyed by the blood directly from the diseased cæca into the liver and there deposited in different places. In this organ, they begin to multiply and spread in all directions, thereby forming the spherical centers of disease which appear as circles on the surface of the liver. This theory is borne out by the results of the microscopic examination.

The course of the disease is variable. In some cases, it develops rapidly after infection and the affected birds die in from two to six weeks. In other cases, the morbid process may come to a standstill, but the amount of dead tissue in the cæca and liver may be so great as to favor the entrance of bacteria, which are directly responsible for the death of the bird late in the summer or fall. In still other cases, regenerative processes may begin and lead to complete and permanent recovery.

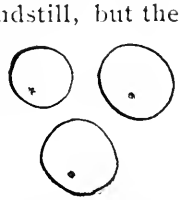

Fig. 21.—The protozoa as they appear when separated from fresh tissue. x 1000.

During the course of the affection, the parasitic protozoa multiply in the cæca, they are mixed with the intestinal contents, and many of them are discharged with the excrement. In this way the contagion is spread. The food and drinking water become contaminated with particles of excrement containing the parasites, the latter are taken by healthy birds into the digestive canal along which they proceed until the cæca are reached, and here they multiply, penetrate

Fig. 22.—Sections of diseased liver; *a*, protozoa in space formerly occupied by liver cells; *b*, capillaries dilated and filled with red corpuscles; *c*, round cells or leucocytes. x 500.

the mucous membrane and set up the changes which constitute the disease.

TREATMENT.—It is evident that the treatment of infectious entero-hepatitis must be principally of a hygienic and preventive nature. Where the disease has existed long upon a farm, the roosting places, runs and feeding grounds must be infected, and the breeding stock are affected in a chronic form and are continually disseminating the contagion. This being the case, adequate measures must be adopted to free the premises from the parasite before healthy stock can be

raised. Thorough disinfection should of course be carried out, using a solution of carbolic acid five parts to one hundred parts of water. All of the turkeys on the farm should be killed in order to certainly get rid of the infected ones. In starting a new flock, obtain eggs from healthy stock and hatch them under common fowls or in an incubator. Raise the young turkeys, if possible, on a part of the farm that has not been infected. By following this course, it should be

Fig. 23.—Section of mucous membrane of diseased cæcum; *a*, nuclei of the epithelium of a crypt; *a'*, mucin cell; *b*, spindle-shaped cells; *c*, protozoa situated within the meshes of the reticulum; *d*, multinucleated giant cell, which has enveloped some of the protozoa. x 500.

possible to eradicate the disease and obtain a healthy flock.

The medical treatment of diseased turkeys has not been successful and it is doubtful if it could be profitably undertaken in any but exceptional cases. Among the remedies most likely to be beneficial are sulphur, sulphate of iron, quinine, salicylic acid, benzonaphthol and betol. Where a flock has recently been infected it would be well to try these remedies with a view of arresting the disease in the mildly affected birds, and of preventing the infection of others by making the intestinal contents unsuitable for the multiplication of the parasite. Sulphur 5 to 10 grains, sulphate of iron 1 grain may be combined and given at one dose. Or give benzonaphthol 1 grain, salicylate of bismuth 1 grain. Or give sulphur 10 grains, sulphate of iron 1 grain, sulphate of quinine 1 grain. Hyposulphite of sodium may be useful in doses of 2 to 4 grains, or betol in the dose of 1 grain. It is necessary that such remedies be repeated two or three times a day and continued for a considerable time to obtain results. The doses mentioned are for birds weighing four or five pounds.

PARASITIC WORMS WHICH INFEST THE DIGESTIVE APPARATUS.

A large number of species of animal parasites are found in the various organs of the digestive apparatus of the domesticated birds. Some of these parasites cause disturbances of the digestive functions or serious disease, while others are apparently harmless. Those only are referred to in detail which are of most importance as disturbers of nutrition or producers of disease. The parasitic worms may be grouped as tapeworms, flukes, roundworms, and thorn-headed worms.

PARASITES OF THE ŒSOPHAGUS AND STOMACH.

The *Dispharagus spiralis*, a round worm about one-third inch in length is found in the œsophagus of fowls. A worm supposed to be of the same species is sometimes found encysted in the connective tissue around the œsophagus, crop, and proventriculus, also in the walls of the intestine and in the mesentery. The *Dispharagus nasutus*, a worm about one-fourth inch long has been found in the walls of the fowl's gizzard. Legros reported an epizootic disease caused by this worm in a poultry-yard where several breeds of fowls were kept, of which the Crevecoeurs suffered most severely. The affected birds became emaciated, were dejected, and died exhausted without having lost their appetite. During their last days they were unusually voracious. The gizzard was studded with the *Dispharagus nasutus*, some of which were entirely hidden in the substance of the mucous membrane, while others were fixed in it by one extremity, the other floating freely in the cavity of the organ. In certain places they were packed together in a compact mass.

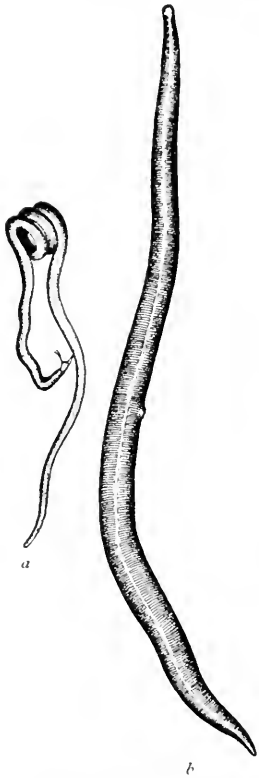

Fig. 24.—Heterakis perspicillum. (*Ascaris inflexa.*) *a*, male, *b*, female. x 2.

The *Trichosoma contortum* is a round worm, the male of which is one-half to three-fourths inch in length and the female one and one-fourth to one and one-half inches. It is found in the cervical dilatation of the œsophagus where, according to Railliet and Lucet, it causes in Pekin ducks an engorgement or obstruction by accumulation of food. This obstruction is analogous to the impacted crop found in fowls and pigeons.

The disease caused by these parasites has been called the ingluvial indigestion of ducks and has been attributed to the food being too dry, or too abundant, or swallowed too hurriedly. The chief factor in causing the disease appears to be this worm, which lives in the walls of the œsophagus, where it bores channels or galleries and weakens the tissues. In examining, after death, the affected birds, the cervical portion of the œsophagus was found enormously distended with food, while its walls were very thin and congested. To the naked eye or through a hand lens the mucous membrane at that part shows white or light yellow lines, sometimes slightly raised above the surface. These lines are found on microscopic examination to be galleries beneath the mucous membrane which have been formed by the worms in their movements, and in which these worms and their eggs may be readily seen. As many as thirty of these worms have been found in the œsophagus of one bird.

The action of this parasite is believed to be mechanical. In boring through the walls of the œsophagus, the tissues are weakened, leading to imperfect contraction of the muscular fibres. The food collects in the cervical dilatation, the contractions of the walls are not sufficiently vigorous to force it onward, and dilation with impaction follows. The impacted œsophagus

presses upon the pneumogastric nerve and may produce asphyxia. The disease appears to be confined to young Pekin ducks. The symptoms are arrest of growth, emaciation and weakness with sometimes epileptiform attacks. In about five to ten days a swelling at the lower part of the neck is observed which rapidly increases, leading to death in one or two days.

TREATMENT.— Garlic may be mixed with the feed as recommended for the *Syngamus trachealis* or gapeworm. Probably one of the best remedies is essence of turpentine. It may be mixed with twice its quantity of olive oil and one to two tablespoonfuls given for a dose.

PARASITES OF THE INTESTINES AND PERITONEUM.

The following list comprises the parasitic worms of the intestines and of the neighboring parts. It is given in condensed form in order to convey a clear idea of the number and location of these parasites and the species of birds which they infest. The word fowl is used to designate the common barn-yard fowl (*Gallus domesticus*).

TAPEWORMS (CESTODA).

Bothriotænia longicollis. Fowl; ¾ to 1 in. long; ⅙ in. wide; intestine.

Cotugnia digonopora. Fowl; 1½ to 3 in. long; ⅛ in. wide; small intestine and cæca.

Davainea cesticillus. Fowl; 4 to 5 in. long; 1-25 to 1-12 in. wide; intestine.

Davainea crassula. Pigeon; 8 to 16 in. long; ⅛ in. wide; intestine.

Davainea echinobothrida. Fowl; 2 to 4 in. long; 1-25 to ⅛ in. wide; intestine.

Davainea proglottina. Fowl; 1-16 to 1-12 in. long; 1-50 in. wide; intestine.

Davainea struthionis. Ostrich.

Davainea tetragona. Fowl; ½ to 8 in. long; 1-16 to ⅛ in. wide; intestine.

Dicranotænia coronula. Duck; 5 to 8 in. long; 1-15 to ⅛ in. wide; intestine.

Dicranotænia sphenoides. Fowl; 1-12 to 1/6 in. long; 1-25 in. wide; intestine.

Drepanidotænia anatina. Duck; 8 to 12 in. long; 1-12 to 1/8 in. wide; intestine.

Drepanidotænic faciata. Goose; 2 to 6 1/2 in. long; 1-25 to 1-12 in. wide; intestine.

Drepanidotænia gracilis. Duck and goose; 10 in. long; 1-16 to 1-12 in. wide; intestine.

Drepanidotænia infundibutiformis. Fowl and duck; 1 to 8 in. long; 1-25 to 1-12 in. wide; intestine.

Drepanidotænia lanceolata. Duck and goose; 1 to 6 in. long; 1/4 to 1/2 in. wide; intestine.

Drepanidotænia setigera. Goose; 8 in. long; 1-25 to 1/8 in. wide; intestine.

Drepanidotænia sinuosa. Duck and goose; 2 to 7 in. long; 1-25 to 1-12 in. wide; intestine.

Drepanidotænia tenuirostris. Goose; 4 to 5 in. long; 1-25 to 1/8 in. wide; intestine.

Echinocotyle Rosseteri. Duck; young specimens 1-16 in. long; 1-100 in. wide; intestine.

Tænia cantaniana. Turkey; 1/2 in. long; intestine.

Tænia Delafondi. Pigeon; intestine.

Tænia exilis. Fowl; 1 in. long; 1-25 to 1-12 in. wide; intestine.

Tænia Krabbei. Goose.

Tænia malleus. Fowl and duck; 1 1/2 to 8 in. long; 1/6 in. wide; intestine.

Tænia megalops. Duck; 1-5 to 2 in. long; 1-20 in. wide; intestine.

FLUKES (TREMATODA).

Cephalogonimus ovatus. 1/6 to 1/3 in. long; 1-12 to 1/6 in. broad; fowls and geese; bursa of Fabricius.

Crossodera linearis. 1/2 in. long; 1-16 in. broad; fowls; cæca and rectum.

Echinostomum echinatum. Light red in color 1/6 to 1/3 in. long, 1/2 in. broad; fowls, ducks and geese; cæca and rectum.

Mesogonimus commutatus. 1/3 in. long, 1-12 in. broad; fowls and turkeys; cæca.

Notocotyle verrucosum. Pink in color, 1-12 to 1/4 in. long; 1-30 to 1-20 in. broad; fowls, ducks and geese; cæca.

ROUND WORMS (NEMATODA).

Ascaris crassa. Male 1/2 in. long; female 2 in. long; duck; intestine.

Heterakis compressa. Male 2 in. long; female 3¾ in. long; fowl; intestine.

Heterakis differens. Slightly larger than *papillosa*; fowl; posterior portion of intestine.

Heterakis dispar. Male ½ to ⅔ in. long; female ⅔ to 1 in. long; goose; cæca.

Heterakis maculosa. Male ⅔ to 1 in. long; female 1 to 1½ in. long; pigeon; intestine.

Heterakis papillosa. Male ⅓ in. long; female ½ in. long; fowl, turkey, guinea fowl, goose, and peacock; cæca.

Heterakis perspicillum. Male 1 to 3 in. long; female 2¾ to 5 in. long; fowl and turkey; small intestine.

Strongylus tenuis. Male ¼ in. long; female ⅓ in. long; goose; intestine.

Trichosoma anatis. Male ½ in. long; female 1 in. long; goose; cæca.

Trichosoma annulatum. Male ⅔ in. long; female 3 in. long; fowl; intestine.

Trichosoma collare. Male ⅓ in. long; female ⅓ to ½ in. long; fowl; intestine.

Trichosoma longicolle. Male ⅔ to 1 in. long; female 3 in. long; fowl; intestine.

THORN-HEADED WORMS (ACANTHOCEPHALA).

Echinorhynchus filicollis. Male ⅓ in. long; female ½ to 1¼ in. long; duck; intestine.

Echinorhynchus polymorphus. ⅙ to 1 in long; orange-red; duck and goose; intestine.

Echinorhynchus sphærocephalus. ¼ to ⅔ in. long; duck; intestine.

SYMPTOMS.— The symptoms which indicate the existence of worms in the intestines are not very characteristic, but are such as would be expected from ill-health due to any chronic disease. The birds become dull, weak, emaciated, isolate themselves, are indisposed to search for their food, are stiff in their walk, their plumage loses its brilliancy and becomes rough, they have diarrhea and sometimes epileptiform attacks. In certain cases the symptoms develop rapidly and

birds die as though from an acute disease. The most certain evidence of the nature of the trouble is the discovery in the intestines of large numbers of one or more of the species of worms mentioned above, upon examination of birds from the flock which have died or which have been killed.

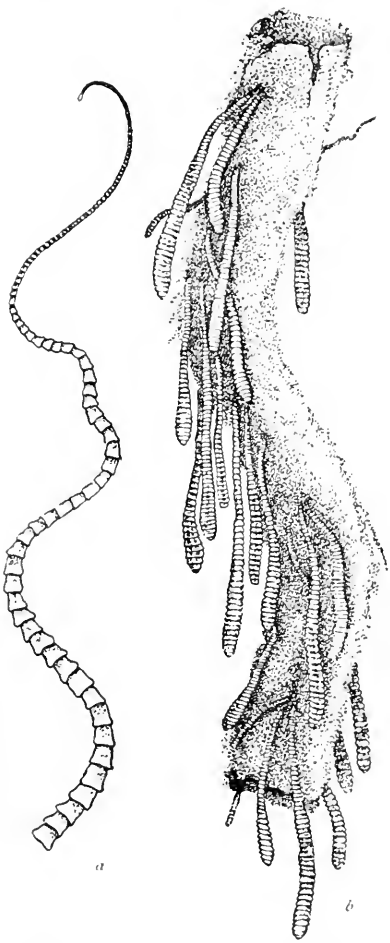

Fig. 25.—Drepanidotænia infundibuliformis. *a*, worm natural size; *b*, an inverted piece of chicken's intestine with numerous tapeworms attached.

According to Nessl, the young fowls which harbor numerous tapeworms lose their appetite, become emaciated, dull and feeble, isolate themselves and hold the head under the wing. Other authorities have observed diarrhea, sometimes epileptiform attacks, stiffness in movement and the legs straddling. The only certain sign is the presence of sections of the tapeworms in the excrement.

An enzootic of tæniasis (tapeworm disease), which killed 30 out of a

flock of 36 geese on one farm, was reported by Lucet. These birds had been gathered from different places, were about two months old, and it was supposed they had acquired the germs in a pool where they drank. The disease was at first obscure, and was manifested by arrest of growth, emaciation, difficult and stumbling walk, a yellow and fetid diarrhea, and plaintive cries emitted from time to time. The appetite remained normal until nearly the last—death ensuing in five to seven days after the appearance of the first symptoms. The disease was due to *Drepanidotænia setigera*. The number in each goose was always high, as many as 93 being found. With these worms were also found 3 or 4 of the *Drepanidotænia lanceolata*.

Various authors have reported enzootics due to the *Heterakis perspicillum* (*Heterakis inflexa*). Megnin gives the symptoms as loss of appetite, emaciation, indifference, somnolency with sudden starts of wakefulness, and diarrhea. In one outbreak about thirty worms were found in each fowl that had died; in another, pellets of the worms as large as a pigeon's egg were found obstructing the duodenum.

Lucet observed verminous enteritis in poultry-yards, due to the association of various species of worms. The affection made slow progress, and the fowls attacked preserved their appetite, but lost condition and became dull and indifferent. Later, the plumage lost its lustre and became erect; while the wings were drooping and the movements languid. A fetid diarrhea set in, wasting became more marked, and the appetite was diminished. Soon the creatures remained immovable and huddled up, with their eyes half closed; the comb and mucous membranes lost their color; the tempera-

ture was below normal; the appetite disappeared, and the feet were swollen. These fowls often yawned, and their torpor and anæmia were extreme; death ensued in a tranquil manner in the course of one or two months. On *postmortem* examination there was observed, in addition to the emaciation, the lesions of a chronic diarrheic enteritis and the following parasitic worms: *Davainea proglottina*, *Drepanidotænia infundibuliformis*, *Davainea cesticillus*, *Heterakis papillosa*, *Heterakis perspicillum* and *Trichosoma collare*. The *Davainea proglottina* was the principal cause of the malady and in each case was found in thousands. The *Heterakis papillosa* and *Heterakis perspicillum* were less constant, though they had taken a good share in the development of the disease.

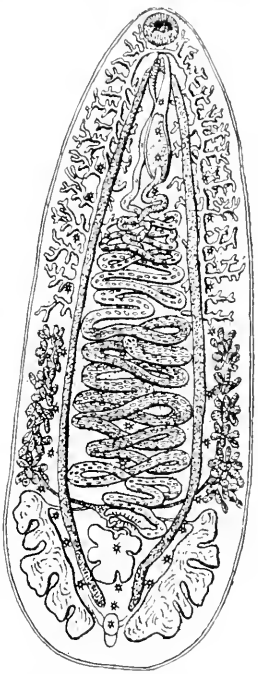

Fig. 26.—Notocotyle verrucosum.

The *Heterakis maculosa* often exists in enormous numbers in the intestines of pigeons and may be so disastrous in their effects as to prevent the raising of these birds. As many as 400 to 500 of these worms may be found in the intestine of one bird. A microscopic examination of the affected bird's excrement reveals innumerable masses of the ova or eggs of the Heterakis. In about 7 grams (2 drams) of excrement passed by a

diseased pigeon in twenty-four hours, Unterberger found on an average 12,000 of these eggs. Some of these eggs were placed on damp blotting paper in a flask and their evolution studied. The embryos were well formed in about 17 days. These ova were then given to perfectly healthy pigeons, when they were, in about three weeks, transformed into adult worms. When, on the other hand, healthy pigeons were given the ova immediately after their expulsion with the fæces, or their discharge from the oviducts, they did not develop, and were passed with the excrements intact or slightly digested. The evolution of the parasite, therefore, can only take place beyond the intestine, without the necessity, however, of an intermediate host. Infestation takes place from pigeon to pigeon, through the medium of the food soiled by the excrements of the diseased birds.

TREATMENT.— Parasitic infestation of the digestive tract should be guarded against by hygienic measures so far as possible One of the most important of these measures is to move the fowls upon fresh ground every two or three years, or certainly in all cases where such parasites are frequently observed in the intestines of the birds. Another practical measure, which may be adopted at the same time, is to remove the excrement daily from the houses and destroy any parasites or their eggs which may be in it, by mixing it with quick lime or saturating it with a ten-per-cent solution of sulphuric acid. The acid is cheap, but requires that great care be taken in diluting it, owing to danger of its splashing upon the clothing and flesh and causing severe burns. It should always be poured slowly into the water used for dilution, but on no account should

water be poured into the acid as it will cause explosions and splashing.

When treating diseased birds these should always be isolated and confined, and their droppings should either be burned or treated with lime or sulphuric acid as just recommended. Without these hygienic measures, medical treatment can only be partially successful.

One of the best methods of treating tapeworms in fowls is to mix in the feed a teaspoonful of powdered pomegranate root bark for every fifty head of birds. In treating a few birds at a time it is well to follow this medicine with a purgative dose of castor oil (two or three teaspoonfuls). According to Zurn, powdered areca nut is the best tapeworm remedy for fowls, but he states that turkeys are unfavorably affected by it. It may be given in doses of 30 to 45 grains mixed with butter and made into pills. Male fern is also a very effectual remedy and may be used in the form of powder (dose 30 grains to 1 dram) or of liquid extract (dose 15 to 30 drops). It should be given in the morning and evening, before feeding. Oil of turpentine is an excellent remedy for all worms which inhabit the digestive canal. It may be given in the dose of one to three teaspoonfuls, and is best administered by forcing it through a small flexible catheter that has been oiled and passed through the mouth and œsophagus to the crop. This medicine is less severe in its effects if diluted with an equal bulk of olive oil, but, if it fails to destroy the parasites when so diluted, it may be given pure. The method of administering medicine by depositing it directly in the crop can be advantageously used with many other liquid remedies, and should be adopted in all cases where it is important to have the full dose in

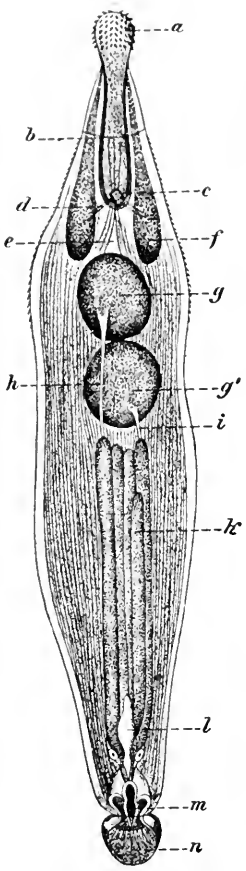

Fig. 27.—*Echinorhynchus polymorphus*, male; magnified 20 diameters. *a*, proboscis; *c*, nerve ganglion; *e*, suspensory ligament; *f*, lemnisca; *g*, *g'* testicles; *h*, *i*, deferent canals; *k*, prostate glands; *l*, seminal reservoir; *m*, penis; *n*, caudal pouch.

the stomach in a short time. It does away with the uncertainty attending the giving of medicine in the feed or drinking water, and with a little practice is more expeditious than making and giving pills. The open end of the catheter may be inserted into a rubber bulb having one opening. Just sufficient air should be expelled from the bulb, so that the dose of medicine will be sucked up without being followed by much air. The bird's head is then brought in a line with the neck, which is extended, the catheter is passed carefully to the crop, when a slight pressure on the bulb forces out the medicine, and the instrument is withdrawn. The operator should be sure that he avoids the trachea.

For the treatment of the heterakis, Megnin recommends mixing santonin with the food given to the fowls. The powdered santonin may be incorporated in a cake, the dose being 7 or 8 grains for each bird. An efficient remedy is made by boiling an ounce each of male fern, tansy and savory in a pint of water. The resulting liquid is mixed with flour, which is then made

into pills and administered to the affected birds. Lucet has successfully treated verminous enteritis caused by tapeworms and the heterakis, by giving intermittent doses of calomel, 1-6 to 1/3 of a grain, and mixing with the feed the heads of santonin, artemisia vulgaris and wormwood.

In treating heterakis infestation in pigeons, the healthy should be separated from the diseased; the walls, perches, ceilings, nests, floors and feeding and watering vessels must be kept scrupulously clean and frequently disinfected; the grain upon which they are fed should not be scattered over the ground but placed in proper receptacles which are not likely to be contaminated with the excrement. It is well to mix aniseed, salt, and other substances appetizing to pigeons, and also coarsely powdered areca nut, with the grain. Each diseased pigeon may be given 1-10 of a grain of calomel worked up with soft bread or made into pills with butter (Zurn). Some authors recommend feeding peas which have been macerated for several hours in a cold decoction of wormwood. The remedies which have been used for heterakis in fowls are also applicable to pigeons.

No treatment is given for fowls affected with trematodes or flukes as these parasites so far as is known do not affect the health of the birds which they infest.

THE NODULAR TÆNIASIS OF FOWLS.

An intestinal disease of fowls, characterized by nodules closely resembling tubercles in the walls of the small intestine and colon, was described by Moore, in 1895, as the result of investigations conducted for the Bureau of Animal Industry. On the serous surface of the intestine these nodules

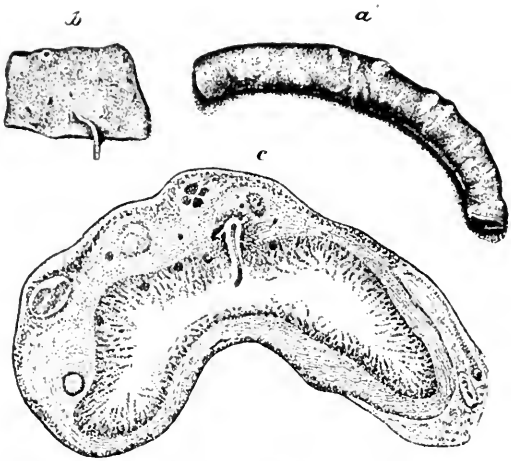

Fig. 28.— *a* Piece of the intestine of a fowl showing the nodules (reduced one-third). (*b*) The mucosa of the intestine showing ulcerated areas; also several small and one larger tapeworm attached to the intestine (reduced one-third). (*c*) A cross-section of the intestine illustrating the thickening of the wall due to a large number of the nodules; also a portion of a tapeworm which has penetrated the mucous membrane, magnified.

have the appearance of closely set protuberances, some being so small that the elevation caused by them is scarcely visible, while others are larger, reaching 1-6 inch in diameter. The larger nodules are of a pale or dark yellowish color, while the smaller ones vary in shade from this to the neutral gray of the normal serous membrane. To the touch they give the sensation of small, oval, solid bodies in the wall of the intestine. The mucous surface presents similar elevations and attached to this over the elevations a number of tapeworms are seen. In the more advanced cases a variable number of small ulcerated depressions, 1-25 inch in diameter or less, are seen over the larger nodules caused by sloughing of the mucous membrane.

The larger nodules contain a greenish-yellow necrotic substance. The contents of the smaller nodules is more purulent, while the smallest appear simply as an area of infiltration. Microscopic examination shows that the heads of the tapeworms have penetrated the mucous membrane and are situated in different layers of the intestinal wall. They are frequently observed between the villi. The heads are not readily detected in the necrotic mass contained in the larger nodules but may almost invariably be seen in the smaller ones. In some cases the tapeworm can be traced through the mucous membrane to the nodule in the muscular coat in which its head appears. The worms attached to the mucous membrane are usually small, but larger ones believed to be of the same species are found in the intestinal contents. If the intestine is opened and the mucous surface carefully washed under a stream of water, the small worms are clearly observed hanging from the mucous membrane. The nodules are most numerous in the lowest third of the small intestine, but are occasionally

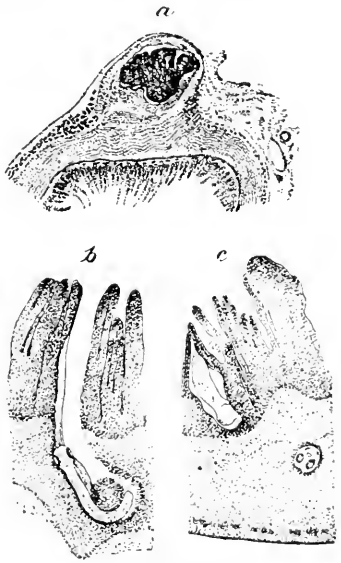

Fig. 29.—*a* A cross section of a nodule containing a sequestrum situated in the outer or longitudinal muscular layer, circular layer of the muscular wall not affected). (*b*) A section showing a tapeworm and a necrotic mass within the muscular wall. (*c*) A portion of a cross-section of the intestine showing the head of a tapeworm within the muscle and one lying between the villi with its head resting on the basement membrane of the mucosa, magnified.

found in small numbers in both the duodenum and colon. The larger and to all appearances the older nodules are found in the ileum near the cæca.

The only symptom noted in connection with this disease is emaciation in the advanced stages. The affection probably can only be recognized by a *post-mortem* examination of the affected birds. It is of particular importance that the principal features should be known, in order to prevent this disease being confounded with tuberculosis.

The tapeworm which causes this malady is believed to be the Davainea tetragona, though on account of the unsettled condition of the classification of avian tapeworms it is difficult to make a positive determination of the species at this time.

No experiments have yet been made as to the best treatment for this form of tæniasis, but the hygienic measures and medical treatment recommended for tapeworms in general are applicable to this, as well as to other species. Vigorous measures should be instituted as soon as the malady is recognized or all of the birds running together will soon become infested, and a long time will be required to eradicate it from the flock and from the premises.

CHAPTER V.

Diseases of the Peritoneum, Liver, and Spleen.

PERITONITIS, INFLAMMATION OF THE PERITONEUM—CHRONIC PERITONITIS, ASCITES, ABDOMINAL DROPSY—DISEASES OF THE LIVER—CONGESTION OF THE LIVER—INFLAMMATION OF THE LIVER, HEPATITIS—ICTERUS, JAUNDICE, BILIARY REPLETION—ATROPHY OR WASTING OF THE LIVER—FATTY DEGENERATION OF THE LIVER—FATTY LIVER—TUBERCULOSIS OF THE LIVER, SPLEEN AND PERITONEUM.

PERITONITIS, INFLAMMATION OF THE PERITONEUM.

THE peritoneum is the delicate serous membrane which lines the abdominal cavity and covers the surface of the organs situated in that cavity. Inflammation of this membrane sometimes occurs as a result of the extension of a severe inflammation of the intestine, liver or kidneys to this neighboring tissue; or from perforation of the intestine and the escape of a portion of the intestinal contents into the abdominal cavity, or from rupture of the oviduct. It is also caused by injuries or bruises of the abdominal wall; and by the irritation due to parasites in the abdominal cavity, or by the introduction of septic matter in the operation of caponizing.

Symptoms.—The acute cases develop rapidly and with much intensity. There is loss of appetite, fever, restlessness, and painful efforts to void the excrement. The abdominal walls are hot and painful if pressed upon, the birds rapidly lose strength, until no longer

able to stand and there are convulsive movements of the limbs followed by death.

On opening the abdominal cavity of birds which have died the lining membrane is found to be deep red in color, and is sometimes covered by an exudate which may consist of a thin transparent fibrinous layer or it may be thick, yellowish or reddish-yellow and opaque. The abdomen may contain more or less liquid which may be transparent or it may be turbid and tinged with a yellow, or reddish-yellow color. If the trouble is due to perforation of the intestine, this liquid will have a very offensive odor from the multiplication of putrefactive germs. If it has resulted from rupture of the oviduct, an egg, either intact or broken, will generally be found in the abdominal cavity and the ruptured place in the wall of the oviduct is easily discovered.

TREATMENT.— Peritonitis is a very difficult disease to treat and it is only in the milder cases that success can be reasonably expected. The affected birds must be kept quiet and protected from currents of air, and opium in doses of one grain every four hours is recommended to quiet the pain and reduce the movements of the intestine, or mix 3 or 4 drops of tincture of aconite in half a glass of water and give a teaspoonful three or four times a day. Injections of tepid water are indicated to counteract constipation. Flannels dipped in hot water should be squeezed partly dry and applied to the abdominal wall, renewing them as often as necessary to keep up a moist heat. This treatment should be continued for half an hour to an hour, and repeated three or four times a day, drying the surface well, afterwards, so that the bird will not take cold. If there is great weakness one or two

drops of ether or four or five drops of tincture of camphor may be injected under the skin as a stimulant.

In case the disease is due to rupture of the oviduct or perforation of the intestine, treatment is useless; if it has followed inflammation of the intestine, the treatment for enteritis should be combined with that for peritonitis. Peritonitis from caponizing should be guarded against by sterilizing the instruments and applying a germicide (corrosive sublimate 1 grain, water 4 ounces), to the skin before beginning the operation.

CHRONIC PERITONITIS, ASCITES, ABDOMINAL DROPSY.

Liquid in the abdominal cavity may result from a mild or chronic case of peritonitis, and it is said by some writers to be due to anæmia in young birds, and to the obstruction of the venous circulation in older ones. The condition is shown by the enlargement of the abdomen which is distended until it nearly or quite reaches the ground when the bird is standing. If examined by slight pressure of the hand the swelling is found to be soft and fluctuating; it will yield in one place and cause a greater distension at another. That is, it gives the sensation of a sac filled with liquid.

Fowls affected in this way are dull, disinclined to move, generally feeble, with pale comb and diminished appetite.

The treatment of this condition is not profitable, but, in special cases, stimulating diet with considerable animal food, tonics and diuretics, may be tried. Iodide of potassium or iodide of iron in doses of 1 grain is particularly indicated.

DISEASES OF THE LIVER.

The liver is one of the largest and most important

organs in the bird's body. It not only prepares the bile, which is one of the principal digestive liquids, but it assists in some of the most necessary chemical changes which occur in the blood. This organ contains numerous blood vessels through which passes a very large quantity of blood, and it is particularly subject to the attacks of various kinds of parasites. Most of these parasites probably find their way to the liver through the blood channels, lodge in the minute capillary vessels, and begin their multiplication and disease-producing action.

Among the parasites which most frequently affect the liver of fowls are the chicken cholera bacteria, the tubercle bacillus, the protozoa of black-head (turkeys), and the aspergillosis fungus. These variously cause congestion, inflammation, and death of the tissue.

The liver is very subject to congestion and this frequently occurs from errors in feeding and as a result of irritation in the neighboring intestines; it is, also, frequently affected with atrophy and fatty degeneration.

CONGESTION OF THE LIVER.

The liver of fowls is often found in a congested condition as the result of lack of exercise combined with over-feeding; also from the birds taking tainted or moldy food or poisonous substances of various kinds into their digestive organs; from the effects of infections diseases, particularly cholera; and from obstruction to the circulation of blood by disease of the heart or lungs. It is often seen in birds which are in plethoric condition or very fat.

The symptoms are obscure and it is difficult to make a diagnosis during the life of the affected bird.

The *postmortem* examination reveals a greatly enlarged liver engorged with blood, tender and easily torn or crushed.

If the condition is suspected in time for treatment give sulphate of magnesium or sulphate of sodium in a purgative dose (20 grains to a dram) and follow with sulphate of magnesium 10 grains, bicarbonate of sodium 2 grains, repeated daily for a week.

The disease should be prevented by proper feeding, regular exercise, and protection from parasites and infectious diseases.

INFLAMMATION OF THE LIVER, HEPATITIS.

This disease is due to the causes enumerated as producing congestion of the liver and is a different and more advanced stage of the same process.

The symptoms are loss of appetite, sluggishness, tenderness over the abdomen and sometimes a yellowish color or jaundice of the skin.

The treatment of birds so affected is not profitable unless they are very valuable for breeding or exhibition purposes. It is well to begin with 1-2 to 1 grain of calomel, followed with 20 grains of Epsom salts and 2 grains of bicarbonate of soda after twelve hours. Naphthol or benzonaphthol may be given twice a day in 1 grain doses to disinfect the intestinal canal. If the diarrhea is excessive and weakens the bird, treat as recommended for that disease.

When marked improvement is shown, give green food, tonics, and raw beef, and allow the bird free exercise in the open air.

ICTERUS, JAUNDICE, BILIARY REPLETION.

According to Megnin, moderate and persistent congestion of the liver, whether due to plethora or to long continued use of food containing a large proportion

of starch or oil, such for example as corn, may lead to an exaggeration of the functions of the liver characterized by the accumulation of a large quantity of bile in the gall bladder, or in the gall ducts of birds, like pigeons, which have no gall bladder. The bile is so abundant that it penetrates the adjoining organs by imbibition and colors them for a considerable distance. In some cases the bile is thick, dry and hard like a piece of black soap.

In these cases the bile distends the gall bladder and the ducts, sometimes because of its abundance, at other times because owing to its thickness it does not flow freely into the intestine and in still other cases because the caliber of the duct has been reduced by inflammation. In all of these cases the result is the same—the bile is absorbed by the blood vessels, causes jaundice and poisoning, which soon leads to the death of the bird.

Unfortunately, the nature of the disease is only occasionally suspected before death. With birds having combs and wattles, or those which have the borders of the eyes or cheeks free from feathers, a close observer may detect the yellowish or mahogany color of these parts.

When this symptom is observed, or when upon *post-mortem* examination of a bird the distention of the biliary reservoirs is made out, and other birds are thought to be similarly affected, Megnin recommends purging with 1-2 to 1 grain of aloes, and a complete change of food giving as great a variety of ingredients as is convenient.

ATROPHY OR WASTING OF THE LIVER.

The wasting or shrinkage of the liver, known technically as atrophy, is generally associated with hard-

ening and sometimes with a marked yellow coloration. It has been considered by some authorities as due to compression, and may result from this cause when there is a great accumulation of fat in the abdominal cavity. In most cases, it probably results from chronic inflammation. Some excellent authorities regard it as caused almost entirely by infections and intoxications. No doubt most forms of irritation which set up chronic inflammation, will produce atrophy.

In this disease the surface of the liver is often more or less granular, the small centers of glandular tissue being shrunken, undergoing degeneration, and surrounded by thickened connective tissue. This process is accompanied by the obliteration of old vessels and the formation of new ones, there is even a formation of new bile ducts, which, however, is more or less incomplete as most of the new ducts fail to perform their functions.

The symptoms are obscure and the disease difficult to recognize during the life of the bird. There is seen only dullness, drowsiness, stupor and possibly convulsions.

This disease should be guarded against by giving a properly balanced ration, being particular to avoid an excess of starch or fat. Allow plenty of exercise with green feed, avoid grain or meal that is musty or moldy as well as decomposing food of any kind.

The early stages of atrophy should be treated with calomel, saline purgatives and alkaline salts as recommended for hepatitis.

FATTY DEGENERATION OF THE LIVER.

This is a rather common disease of birds, and has been attributed to lack of variety in the food, too close confinement and insufficient exercise.

On *postmortem* examination the liver is found shrunken, hardened and marbled or spotted with areas of grayish or yellowish tissue. A microscopic examination shows the liver cells to contain droplets of fat and the liver tissue degenerated and largely replaced by yellow fat globules.

As the disease is not recognized during life, treatment is out of the question. If a number of cases occur in the same flock, give greater variety of food and a run on grass. In addition, bicarbonate of soda may be given in the drinking water to the amount of one or two grains a day for each bird.

FATTY LIVER.

It is contended by authors who have examined into the subject, that the fatty livers which are so skillfully developed by certain feeders of geese and ducks, and which are considered a great table delicacy should not be confounded with livers which have undergone fatty degeneration. The latter is a disease while the former is simply a physiological condition. In fatty degeneration the liver is shrunken, there is a formation of fat within the cells and destruction of the cells, while in fatty livers the fat is deposited between the microscopic elements of the liver, and this organ is thereby enlarged and rendered more succulent and delicate, but there is no destruction of the cells. If the process of fattening is properly carried out there is, consequently, no disease.

TUBERCULOSIS OF THE LIVER, SPLEEN AND PERITONEUM.

This disease is manifested by whitish or yellowish-white nodules and aggregations of nodules varying in size from a mere point to an inch or more in diameter.

These develop either in the peritoneum or in the tissue of the liver and spleen. Rupture of the liver with fatal bleeding is said to be sometimes observed in cage birds affected with tuberculosis. The disease is of the same nature as tuberculosis of the lungs, and is treated at length in another chapter. As the disease is incurable, no treatment is recommended, beyond the sanitary measures for the eradication of the contagion mentioned in the general article upon this subject.

CHAPTER VI.

Diseases of the Organs of Urination and Reproduction.

BRIEF DESCRIPTION OF THE ORGANS OF URINATION—PARENCHYMATOUS NEPHRITIS, INFLAMMATION OF THE KIDNEYS—ABSCESS OF THE KIDNEYS—OBSTRUCTION OF THE CLOACA BY URINARY CONCRETIONS—THE MALE ORGANS OF REPRODUCTION—HYPERTROPHY OR ENLARGEMENT OF THE TESTICLES—CANCER OF THE TESTICLES—FATTY DEGENERATION—THE FEMALE ORGANS OF REPRODUCTION—ATROPHY OF THE OVARY—TUMORS OF THE OVARY—GANGRENE OF THE OVARY—INFLAMMATION OF THE OVIDUCT—PROLAPSUS OR EVERSION OF THE OVIDUCT—DIFFICULT LAYING, EGG BOUND, OBSTRUCTION OF THE OVIDUCT—GANGRENE OF THE OVIDUCT—RUPTURE OF THE OVIDUCT—CLOACITIS, VENT GLEET—ANOMALIES IN EGG PRODUCTION—EGG INCUBATED IN THE OVIDUCT—PARASITES IN EGGS—SANGUINEOUS EGGS—EGGS WITHOUT SHELLS—EGGS WITH TWO YOLKS—INCOMPLETE OR ABORTED EGGS—EGGS WITHIN EGGS.

BRIEF DESCRIPTION OF THE ORGANS OF URINATION.

THE urinary apparatus of birds consists of two kidneys and two ureters. There is no bladder, the cloaca forming a common receptacle for both urine and fæces. The kidneys are elongated in form, commencing immediately below the lungs and extending along the sides of the spine as far as the termination of the rectum. They present inequalities of surface corresponding to the elevations and depressions of the walls of the pelvis. The kidneys of birds are divid-

ed into three quite distinct lobes, each lobe connecting with the ureter. The texture of the kidneys is much more frail than in mammalia, readily yielding under the pressure of the finger. The lobes are made up of lobules having somewhat the appearance of the convolutions of the brain. The uriniferous tubes do not empty into a cavity or pelvis in the interior of the kidney as with mammals, but unite upon the surface of the gland to form the ureter.

The ureters are continued along the surface of the kidney towards the inner side, being here and there imbedded in its substance, presenting a series of dilatations corresponding to the principal lobes, and receiving the branches of the uriniferous tubes as they pass along. Beyond the kidneys the ureters pass behind the cloaca, penetrate its walls, and, finally, end in valvular eminences in the lower part of the cloaca.

The urine as secreted is very thick having the color and consistency of cream, being composed almost entirely of uric acid. It dries to a chalky paste in the cloaca from which it is expelled with the fæces. The excrement of birds, as is well known, is composed of two distinct portions, one white and the other of variable color. The former is the secretion of the kidneys, and the latter is the residue of alimentary matters which has passed through the intestines.

PARENCHYMATOUS NEPHRITIS, INFLAMMATION OF THE KIDNEYS.

A case of this disease is recorded by Megnin as having occurred in a Langshan pullet, seven months old. The symptoms were evident suffering in the vicinity of the kidneys. The bird remained continually lying upon its abdomen, only occasionally rising with difficulty in order to eat. The *postmortem* examination re-

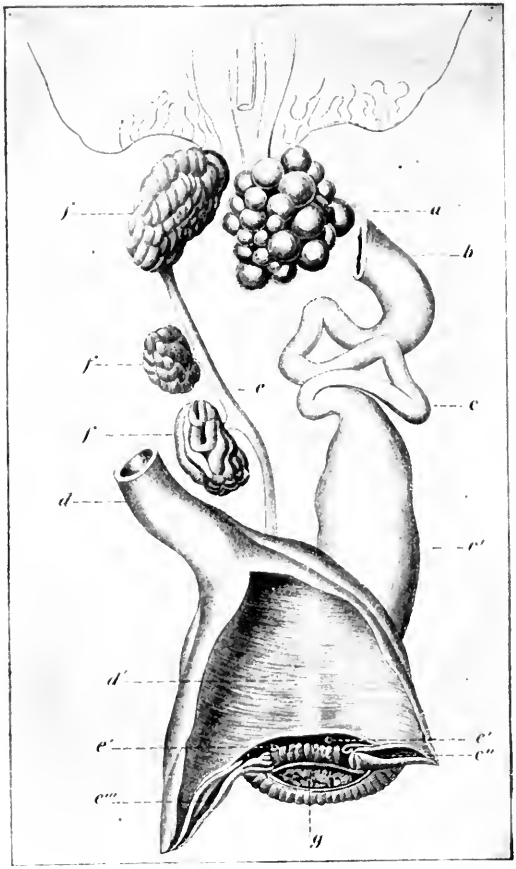

Fig. 30.—Urinary and reproductive organs of the hen: *a*, ovary; *b*, infundibular portion of oviduct: *c*, portion of oviduct which secretes the albumen; *c'*, uterus or shell-forming portion; *d*, intestine; *d'*, cloaca; *e'*, *e''*, opening of ureters; *c''* opening of oviduct; *c'''* depression corresponding to opening of atrophied oviduct; *g*, bursa of Fabricius; *f*, *f*, *f*, kidney divided into three lobes; *e*, right ureter.

vealed an enormous enlargement of the two kidneys, and upon cutting across these organs there were seen numerous black points, each representing a small interstitial hemorrhage.

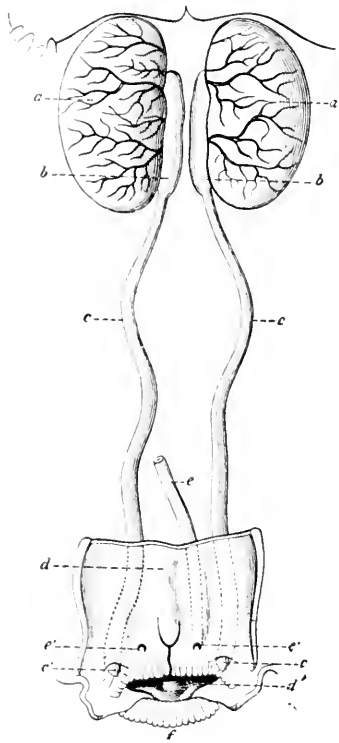

Fig. 31. Reproductive organs of the cock; *a, a*, testicles; *b, b*, epididymis; *c, c*, vas deferens; *d*, cloaca; *d'* bursa of Fabricius; *e', e'*, papillæ through which the vas deferens open; *f*, margin of anus.

The disease has, also been observed by Larcher, Semmer, and others.

It is often seen with pullets. The affected birds stop growing, lose their appetite, become thin, with improperly developed feathers and roughened plumage. The kidneys are found two or three times their normal size, of a grayish color and more firm than in health. Microscopic examination has revealed the existence of minute organisms, and Semmer thinks that the disease might be caused by toxic fungi contained in the food.

ABSCESS OF THE KIDNEYS.

A case of this disease was observed by Megnin in a small cage bird. The kidney was found to contain a yellow nodule formed by dried pus. No other sign of disease was discovered. The bird had been ill for a month but contin-

ued to eat. No information could be obtained as to the cause of the disorder.

OBSTRUCTION OF CLOACA BY URINARY CONCRETIONS.

Numerous instances have been reported of partial or complete obstruction of the cloaca by the drying and hardening of urinary accumulations. This condition is more or less frequent with pigeons, pheasants and fowls. The concretions are usually composed of uric acid or urate of ammonia, but a true calculus made up of the carbonates of lime and magnesia, phosphate of lime and mucus has been found in the kidneys of a fowl.

The concretions in the cloaca are usually associated with improper rations, containing too much of the nitrogenous constituents. The feeding should be corrected, animal food reduced, and a cooling non-stimulating ration substituted. The contents of the cloaca should be carefully softened with warm water and removed. A small quantity of oil injected daily for a week will prevent further accumulations and permit any local irritation to subside. No other treatment is required.

THE MALE ORGANS OF REPRODUCTION.

The male organs of reproduction in fowls consist of two testicles situated in the abdominal cavity, just below the anterior parts of the kidneys, and of two ducts called the vas deferens which conduct the secretion of the testes to the cloaca. It will be observed that the cloaca is the common outlet for the fæces, the urine and the seminal fluid. Each vas deferens opens through a conical papilla in the posterior wall of the cloaca. The papillæ are surrounded by a remarkable plexus of arteries and veins, producing erectile tissue, which makes it possible to bring the seminal

liquid in contact with the everted orifice of the oviduct of the female. In some waterfowls which copulate in water, provision is made for a more efficient coitus by the development of a long intromittent organ from the highly vascular wall of the cloaca. This is seen particularly in the drake. In the passive state this organ is coiled up like a screw by the elasticity of associated ligamentous structures.

Fig. 32.—Testes of the House-sparrow.

HYPERTROPHY OR ENLARGEMENT OF THE TESTICLES.

The testicles of birds vary greatly in size according to the season of the year at which they are observed. In winter they are very small with a comparatively insignificant blood supply, but in spring, as the breeding season comes on, they enlarge to five or ten times the weight during the winter, the vessels are distended with blood and the height of functional activity is reached. The annexed drawing showing the enlargement of these organs in the house sparrow from January to April, serves as an illustration of this process.

While the enlargement just described is strictly physiological, it is frequently exaggerated from various conditions and then becomes a disease. Megnin has

observed cases where one of these organs was nearly fifty times its normal weight; and it is not uncommon to find them two inches in length and nearly as broad.

SYMPTOMS.— Diseases of this character are not easily recognized during the life of the affected bird. As, however, the condition is generally accompanied by some tenderness and pain, there is uneasiness, a tendency to sit down or crouch, or, as Hill puts it, sinking down and rising again, with inclination to remain quiet. Such symptoms occurring during the spring or early summer should lead to the suspicion that the bird is affected with the disease under consideration.

TREATMENT.— Give cooling food with considerable green material in it. Do not allow meat or condition powder of any kind. Keep the affected bird by itself where it will remain quiet.

Give tincture of aconite root $\frac{1}{4}$ drop to 1 drop, according to size of bird, three times a day. It is, also, well to give Epsom salts sufficient to obtain free movement of the bowels, about a teaspoonful for an ordinary sized bird. Some recommend iodide of potassium 3 grains twice daily in a pill or dissolved in a little water.

CANCER OF THE TESTICLES—FATTY DEGENERATION.

Cases are recorded showing that cancer of the testicles and fatty degeneration of these organs are both common with birds. These conditions, however, can not be determined until after the death of the bird and treatment is for that reason out of the question. The diseases mentioned while of scientific interest need not be given detailed consideration in this volume.

THE FEMALE ORGANS OF REPRODUCTION.

In birds, the female organs of reproduction consist of a single ovary and a single oviduct. During the

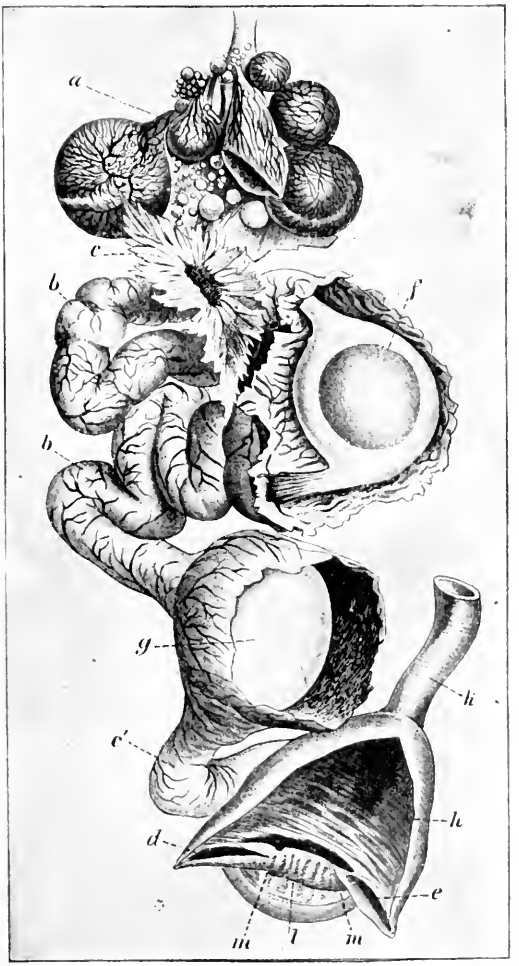

Fig. 33.—R productive organs of the hen; *a*, ovary; *b*, oviduct; *c*, infundibular portion of oviduct; *d*, depression corresponding to atrophied right oviduct; *e*, opening of left oviduct; *f*, oviduct laid open to show egg surrounded with first layers of albumen; *g*, uterus opened to show egg with shell forming upon it; *h*, cloaca; *k*, rectum; *l*, upper portion of anus; *m*, *m*, openings of ureters.

early stages of development of the chick the two ovaries are of equal size, but soon the developmental forces appear to concentrate in the left ovary while the right one remains stationary and ultimately disappears in most birds. The single ovary is developed to a remarkable degree. It is situated near the left kidney and approaches the median line. The external appearance is that of a granular or nodular body attached to the spinal column by a fold of peritoneum. The nodules are irregular in size, some small and whitish, others larger and of a yellowish color.

The enlargement of the ovum is due to the accumulation of the yellow or food yolk, and this causes distension of the ovarian capsule or *calyx* that encloses the ovum. As the ovum enlarges its capsule becomes more and more separated from the remainder of the ovary until it is seen to be attached only by a narrow base or pedicle. The calyx consists of two membranes united by connective tissue and blood vessels. The vessels converge towards a white transverse line or band which crosses the most prominent part of the calyx. At this line the vessels become so minute as to apparently disappear entirely. This band, called the *stigma*, begins to appear when the ova are well developed and the line becomes broader and the membranes thinner as the ovum increases in size, until at the proper time the walls of the calyx give way along this line and the egg slips out of its capsule and passes into the infundibular opening of the oviduct. The empty calyx collapses, rapidly shrinks and is ultimately absorbed.

The ovum as it enters the oviduct consists of a *vitellus* or yolk enclosed in a very thin *vitelline membrane*. Impregnation or fertilization occurs in the

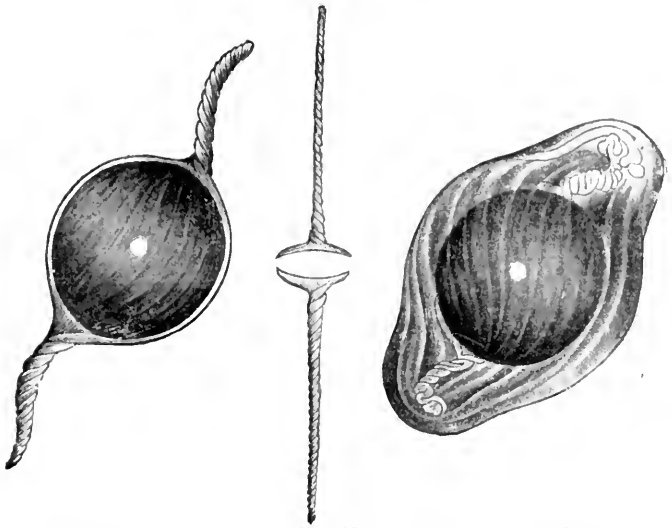

Fig. 34. Fig. 35. Fig. 36.

Fig. 34.—Egg from upper part of oviduct with coating of dense albumen called membrana chalazifera continued into the chalazæ. Fig. 35.—Outstretched chalazæ from opposite sides of the yolk showing opposite turns of the spiral. Fig. 36—Egg from above middle of oviduct with first layers of soft albumen.

upper portion of the oviduct and soon after the egg escapes from the ovary. Having entered the oviduct the ovum is propelled with a rotary motion by the peristaltic contractions of that tube, towards the cloaca. The contact of the ovum stimulates the lining membrane of the oviduct to secrete first a dense layer of albumen which is deposited upon the vitelline membrane and is continued thread-like from each pole. These threads or filaments are the *chalazæ* and the dense layer of albumen with which they are connected is the *membrana chalazifera*. As the egg rotates in the oviduct the *chalazæ* become twisted in opposite directions, and the one next the small end of the egg finally adheres more or less to the membrane lining the shell at that point.

The egg advances into the more glandular and vascular part of the oviduct and here two other layers of albumen are secreted and deposited upon it. Each of these is thinner and more watery than the one which preceded. When the narrow part of the oviduct is reached, two denser layers of albumen are excreted forming the *membrana putaminis*. Enclosed in this manner, having acquired its ovate form and with the

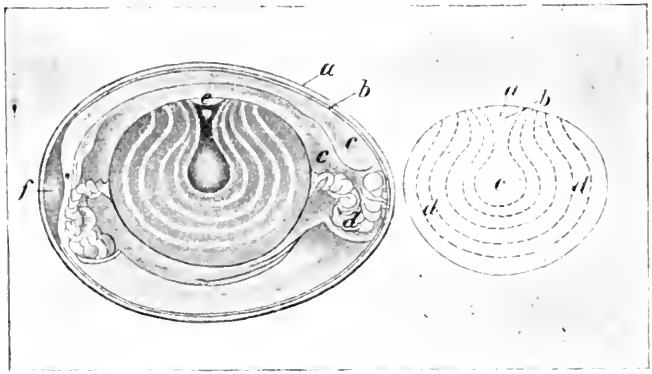

Fig. 37.—Section of fowl's egg; *a*, shell; *b*, membrana putaminis; *c*, *c*, layers of soft albumen; *d*, chalazæ; *e*, cicatricula and germinal vesicle; *f*, air chamber. The outline figure shows the yolk made up of layers deposited successively; *a*, cicatricula, *b*, germinal vesicle.

small end towards the cloaca, the egg enters the uterine or shell-forming dilatation. The inner surface of this portion of the oviduct secretes and deposits upon the *membrana putaminis* a thick white fluid which condenses, becomes calcareous and forms the shell. The time required for the egg to pass from the infundibulum to the uterus, in the common fowl, is said to be from four to six hours, and it may remain here from twelve to twenty hours.

The color of the egg-shell depends upon pigmental matter secreted by particular follicles of the villous

membrane of the uterus. The appearance of pores on the surface of the shell is due to the impressions of the villi of the formative membrane; but the permeability of the shell by the atmosphere depends upon a more minutely porous texture. The shell consists in great part of carbonate of lime, with a little carbonate of magnesia and phosphate of lime and magnesia (Owen).

The oviduct is a whitish tube somewhat larger than the large intestine and shows many branching blood vessels upon its surface. It begins near the ovary by an enlarged portion called the infundibulum, and after being bent upon itself several times and forming three principal convolutions, it reaches the cloaca in which it opens. In the non-breeding season, when the parts are in repose, the ovary and oviduct are reduced in size and almost disappear.

ATROPHY OF THE OVARY.

The ovaries, like the testicles of the male, are greatly reduced in size and atrophied during the non-breeding season. This, however, is a physiological atrophy and not a disease. In the same manner, the ovaries become atrophied in old hens which have ceased laying. This is sometimes, but not always, accompanied by remarkable changes in other parts of the body. The spurs develop, the feathers become longer and more brilliant, resembling those of the cock, or usually approaching more closely to the plumage of the capon. Such birds, also, assume to a certain extent the voice and habits of the male.

The complete atrophy of the ovaries is sometimes congenital, or, more strictly speaking, these organs fail to develop. In other cases, rudimentary organs of both sexes are found in the same individual. Birds in which this condition exists, also, have a resem-

blance in plumage, voice, spurs, habits, etc., to capons, and should be fattened and killed for the table, as they are of no value for other purposes.

TUMORS OF THE OVARY.

There are frequently found tumors of considerable size in connection with the ovary. A common variety is composed of the yolks of eggs which have matured but which have failed to enter the oviduct. These tumors are yellow in color, and are made up of concentric layers in which the yolk can be recognized, as it has somewhat the appearance seen in a cooked egg. Megnin records a case in which this trouble appeared to be hereditary, as all the hens belonging to a particular strain were affected.

In rare instances, the development of the ovum is abnormal, and instead of a mature yolk resulting, the calyx is found to contain only a thin liquid, and the ovary thus becomes transformed into a mass of cystic tumors suspended upon long pedicles. Cancerous tumors of the ovary have also been observed.

Treatment is, of course, impossible in these cases as the nature of the disease is not determined until after the bird's death. If such abnormal conditions are frequently found, it is an indication that there is a predisposition in that direction in the strain of birds. The only way to correct this is to kill off the flock and obtain different blood.

GANGRENE OF THE OVARY.

This disease is quite common with all varieties of poultry. On examination of the ovary after death, the ova are found in different stages of development, but instead of being yellowish-pink in color, with the blood vessels well defined, they are brown or black, easily crushed and the contents broken down into a

putrid liquid. Death is caused partly by peritonitis and partly by the absorption of the products of decomposition.

The cause of this trouble is not well understood. It has been attributed to the birds being too fat, thus compressing the ovary and hindering the evolution of the ova. As it may occur in birds which are not fat, and as it is evidently accompanied by the penetration and multiplication of bacteria, it is possibly an infectious disease.

INFLAMMATION OF THE OVIDUCT.

The oviduct, being a highly vascular tube, with great functional activity during the laying season, and subject to injuries of various kinds, is frequently affected with inflammation.

CAUSATION.—Congestion and inflammation may result from irritation due to too frequent laying, from the eggs being too large, from too stimulating food or condiments, from the breaking of an egg within this tube after the shell has been formed upon it, and from obstruction of the cloaca.

SYMPTOMS.—The bird at first shows indications of a desire to lay without being able to produce eggs, or it may lay eggs containing more or less blood, or eggs without shells, or small and misshapen eggs containing albumen but no yolk, or, finally, the yolk may be dropped without any covering of albumen or shell. As the inflammation increases there is high temperature, straining, and an effort to rub the abdomen upon the ground. In the later stages, the bird becomes dull, indisposed to move, the comb is pale, the plumage rough and the temperature falls to normal or below.

TREATMENT.—This disease to be treated success-

fully must be taken in hand early. Give green and cooling food, avoid meat, condition powders, pepper or other irritating ingredients. Keep the bird quiet and administer Epsom salts 20 grains, bicarbonate of soda 2 grains. Follow this with one-half drop tincture of aconite root three times a day.

PROLAPSUS OR EVERSION OF THE OVIDUCT.

Prolapsus of the oviduct is quite frequently observed particularly in old hens which have been great layers. Over-feeding, too stimulating food, constipation and straining to expel large eggs are direct causes. It may, also, occur as the result of inflammation of the oviduct, or from any condition which prevents the passage of the eggs.

SYMPTOMS.— Prolapsus often occurs from efforts to expel an egg which has become arrested in the lower part of the oviduct and is then first seen as the hen leaves the nest. It may be either complete at first, or only partial. In the latter case a tumor may be noticed as just visible within the cloaca. After a few hours or a day, the eversion continues and a large dark-red or violet-colored mass protrudes from the vent. Inflammation becomes intense in the part exposed to the air, gangrene may set in, and death occurs from purulent absorption or septicæmia.

TREATMENT.— As soon as symptoms of prolapsus are seen, catch the bird and examine it carefully to determine if an egg has been arrested in the passage. If the swelling is soft, with no signs of the presence of an egg, apply carbolized oil or lard and return the part by gentle pressure. After this is accomplished, treat the bird as for inflammation of the oviduct, giving as additional treatment 3 to 5 drops fluid extract of ergot to cause contraction of the oviduct and keep it in posi-

tion. If an egg is found within the swelling treat as recommended for obstruction of the oviduct. In all cases of prolapsus, the oviduct if soiled with adhering manure or dirt should be washed clean with warm water before it is replaced. Keep the bird in a small coop where it will be quiet until it has recovered.

DIFFICULT LAYING, EGG BOUND, OBSTRUCTION OF THE OVIDUCT.

Laying may become difficult because of irritation of the lower part of the oviduct arresting the secretion of mucus and causing the mucous membrane to become dry and lacking in its normal lubrication. The same trouble results from birds being too fat or from the eggs being too large, and is aggravated by constipation. If the cause is sufficiently pronounced in its action, the affected bird may be unable to expel the egg; this is arrested in the passage where it sets up inflammation and leads to straining and possibly to prolapsus of the oviduct.

SYMPTOMS.— When fowls are egg bound they at first go frequently to the nest, making efforts to lay but are unable to accomplish this function. They are restless and evidently in more or less distress. Later they become dull, with rough plumage and are indisposed to move. On examining the bird by pressure of the finger about the vent, the egg can be distinguished as a hard body in the posterior part of the abdominal cavity. In case of prolapsus, the everted oviduct may be easily seen.

TREATMENT.— In the early stages when the irritation is slight, it is sufficient to inject a small quantity of olive oil and gently manipulate the parts. Afterwards, give cooling food, and, if hens are too fat, reduce the ration. In case the expulsion of the egg can

not be obtained by the injection of oil, immerse the vent and lower part of the body in water, as warm as can be used without injury, and hold it there half an hour or more until the parts are relaxed. Then inject oil and endeavor to assist the bird by careful pressure and manipulation, or by dilation of the passage. Fluid extract of ergot is useful in these cases and may be given in five-drop doses three times a day. In some cases it is necessary to puncture the egg, allow the contents to escape, crush the shell and remove it in pieces.

GANGRENE OF THE OVIDUCT.

If an egg which has been arrested in the oviduct can not be expelled, the inflammation which it produces becomes more and more intense until it causes the death of the tissue. When the flesh dies it at once begins to decompose and putrify, and this condition is known as gangrene. The gangrenous walls of the oviduct are easily torn and the egg may then escape into the abdominal cavity. No treatment is of use in such a case as peritonitis and septic infection occur and lead to death in a comparatively short time.

RUPTURE OF THE OVIDUCT.

The walls of the oviduct are sometimes torn or ruptured in the absence of inflammation or gangrene, and simply as the result of vigorous contractions in the efforts to expel an abnormally large egg. A fissure thus formed permits the escape of the egg into the abdominal cavity. This accident may be suspected by the suspension of laying and the enlargement of the abdomen. By pressure of the finger one or more eggs may be located in the lower part of the abdomen. As treatment is unavailing, the better plan is to destroy the bird as soon as the condition is recognized.

CLOACITIS, VENT GLEET.

Fowls are sometimes affected with a contagious catarrh of the cloaca, which is transmitted from bird to bird during the act of copulation. The inflammation is usually confined to the cloaca, but in severe cases may extend to the mucous membrane of the lower part of the oviduct, or even to that of the rectum.

SYMPTOMS.—The first symptom observed is the frequent passage of excrement which is voided in small quantities almost as rapidly as it reaches the cloaca. Often the bird endeavors to drop excrement when the cloaca is entirely empty. This action is due to the tenderness and irritability of the cloaca which gives to the bird the sensation of fullness, and produces spasmodic contractions. If an examination is made the mucous membrane is found in the early stages to be red, dry, swollen and hot. In a day or two a discharge makes its appearance. It is, at first, thin and watery, but soon becomes white, purulent, and offensive. This discharge collects upon the skin and feathers about the vent, obstructs the passage and irritates the parts with which it comes in contact. The soiled skin becomes red and inflamed, it may be abraded by friction or by the bird picking at it, and thus sores or ulcers are started which may become quite troublesome.

TREATMENT.—First reduce the inflammation and clean the parts by holding the lower part of the bird's body, including the vent, in a pan or bucket of warm water, in which has been dissolved a tablespoonful of bicarbonate of soda to each quart of water. The water should be as warm as can be comfortably borne by the hand and the application should be continued for one-half to three-quarters of an hour and should be repeated daily while the inflammation is at its height.

After the bird is removed from the water, it should be dried off with a cloth and a tablespoonful of the following mixture injected into the cloaca: Water 6 ounces, glycerine 2 ounces, morphia sulphate 1 grain, boric acid 1½ drams. A pledget of cotton may be saturated with this mixture and placed in the cloaca two or three times a day, allowing it to remain until expelled by the bird. If the discharge is very offensive a solution of permanganate of potash one grain to the ounce of water may be used as an injection, or, if more convenient, a solution of peroxide of hydrogen. Should the remedies just mentioned fail to give satisfactory results, try a solution of carbolic acid of the strength of one per cent. After the inflammation has subsided, if the discharge continues, an astringent solution may afford relief. For this purpose acetate of lead 4 grains to the ounce of water is suitable; or, in obstinate cases acetate of lead 3 grains, sulphate of zinc 3 grains, water one ounce. The sores and ulcers which form around the vent should be kept dusted with iodoform or aristol.

ANOMALIES IN EGG PRODUCTION.

Eggs are not always laid in a perfect condition. They may be deformed, modified in composition, or may contain foreign bodies. These changes depend upon the condition of the ovary and oviduct during the period the egg is developing. Some abnormal eggs have excited much wonder and discussion, but, if the manner in which the egg is formed is borne in mind there is little difficulty in making a satisfactory explanation.

EGG INCUBATED IN THE OVIDUCT.

It has been shown that the egg normally remains in the uterus or shell-forming portion of the oviduct from twelve to twenty hours, also, that it may become

lodged at this point and be held there for an indefinite time. As the temperature of the bird's body is that most suitable for incubation and for the development of the embryo, it is plain that a fertile egg arrested in the oviduct must soon undergo important changes. For this reason some eggs have the odor and taste that are familiar in connection with stale eggs, although they are newly lain. In rare cases, the egg may be arrested a sufficient time to allow the embryo to become more or less developed. Megnin states that he removed an egg from a fowl, in making a *post-mortem* examination, which contained an embryo upon which the skin and feathers were already formed. Fortunately for the reputation of the egg-producer, such cases seldom occur, and it is doubtful if the hen would succeed unaided in laying an egg which had been retained long enough to allow the embryo to develop. Some stale eggs may, however, be accounted for by prolonged retention in the oviduct.

PARASITES IN EGGS.

As the egg traverses the greater part of the oviduct, and receives in that tube several layers of albumen before the shell is formed, it is not difficult to understand how any parasites which gain entrance to the oviduct may be caught in the albumen and imprisoned within the shell. The lower part of the oviduct has a free opening into the cloaca for the passage of the egg, and it is not surprising that parasites occasionally find their way along this channel. The parasite most frequently found in the egg is the *Cephalogonimus ovatus* (Distoma ovatum), a small fluke which has its habitat in the bursa of Fabricius. More rarely, the common round worm known as the *Heterakis perspicillum (Heterakis inflexa, Ascaris inflexa)* is observed. These two worms evidently pass into the oviduct from

the cloaca. Various fungi and bacteria are also found in eggs. Among these may be mentioned the chicken cholera bacillus, and probably the bacilli of fowl diphtheria and avian tuberculosis. These facts need not influence any one to avoid eggs as an article of diet, since all of these parasites are destroyed by a comparatively low temperature and cooking would remove any danger that might possibly exist. The presence of certain micro-organisms in eggs leads to early decomposition. It is important, for the production of good eggs, that cleanliness and sanitary conditions be enforced in every poultry-yard.

SANGUINEOUS EGGS.

Occasionally small bloodclots are found in eggs, usually in the albumen. These result from a slight hemorrhage which has generally occurred in the upper two-thirds of the oviduct. In rare cases the hemorrhage may have taken place in the ovary and then the blood will be found either upon the surface of or within the yolk. Such hemorrhages are the result of great functional activity and congestion of the blood vessels of the reproductive organs. They are excited by any of the causes which lead to congestion and inflammation and are to be counteracted by green feed, less animal food, and suppression of condiments. In special cases medium doses of perchloride of iron or ergot may be found useful.

EGGS WITHOUT SHELLS.

The production of eggs without shells, or the so-called soft-shell eggs, may be due either to a lack of shell-making material or to inflammation of the shell-forming chamber of the oviduct which no longer secretes calcareous matter. It is, also, said that fright may cause the premature expulsion of an egg before the

shell has been deposited. Eggs without shells are more difficult to lay than are those which are perfect, and, hence, they are frequently retained a considerable time in the uterus, adding to the irritation and inflammation. As treatment in these cases, it is sufficient to remove the cause. Give the fowls plenty of shell-forming material such as wheat bran, crushed egg shells, cut or calcined bone, broken mortar, crushed oyster shells, etc. Give green food and avoid the causes of inflammation of the oviduct.

EGGS WITH TWO YOLKS.

Eggs are frequently found in which there are two yolks, and these are popularly known as double-yolk eggs. They are the result of two ovarian capsules becoming ruptured at about the same time, and the yolks descending the oviduct so near together that both are included in the same shell. Eggs with two yolks are generally larger than others, and there is more danger that they will cause injury to the oviduct. Some hens are habitual layers of such eggs. If incubated, double-yolk eggs generally produce twins, double chicks, or monsters. All such abnormalities are not developed from these eggs, however, as it has been shown by Davaine that a single yolk may contain two germs and give birth to two embryos united in some part of the body.

INCOMPLETE OR ABORTED EGGS.

It is common for hens to drop eggs of only half or a third the diameter of those usually produced. These diminutive productions, often about the size of a pigeon's egg, are provided with a shell sometimes more dense than that of the normal egg. On examination they are found to contain albumen but no yolk. In some cases they contain little but the albumenous

membranes twisted so tightly that they have been taken for worms.

The production of these incomplete eggs is an evidence of irritation in the central portion of the oviduct. It shows that the albumen is secreted without the normal stimulous that is given by the presence of a yolk, and passing down the tube to the uterus is there covered with a shell. The hen laying such eggs should be removed from the flock, kept quiet and treated as recommended for inflammation of the oviduct.

EGGS WITHIN EGGS.

This anomaly, which has been a matter of record for something like two hundred years, is closely related to the one just considered, and is of not unfrequent occurrence. The inclosed egg is a small one, with a shell and contains only albumen. Its production is easily explained. On account of irritation of the central portion of the oviduct, albumen is secreted without the presence of a yolk; this albumen is pressed by the contractions of the tube downwards to the uterus where a shell is deposited upon it. In the effort to expel this small egg irregular contractions are induced which force it upwards for a certain distance where it meets a yolk surrounded with albumen, or a second mass of albumen without a yolk, becomes imbedded in this soft albumen and a membrane and shell are formed around the whole. The compound egg thus formed is usually of normal size. These abnormalities which have excited much wonder in persons ignorant of the physiology of egg production, are in reality very easily understood, and the experienced poultryman will draw the conclusion from their frequent repetition tha his flock is being forced beyond the limit of safety.

CHAPTER VII.

Diseases of the Brain.

CEREBRAL HYPERÆMIA, CONGESTION OF THE BRAIN, VERTIGO — HEMORRHAGE OF THE BRAIN, APOPLEXY—EPILEPSY.

CEREBRAL HYPERÆMIA, CONGESTION OF THE BRAIN, VERTIGO.

CONGESTION of the brain is a disease quite frequently seen with poultry. It may occur in fat and plethoric birds by fright or indigestion. It is frequently associated with irritation of the intestines by parasitic worms. It is seen particularly in male birds during the breeding season and in chickens exposed to the hot rays of the sun. It may, also, occur as the result of blows upon the head and as a complication with infectious diseases such as cholera.

The *symptoms* are giddiness which leads the bird to throw its head upwards and backwards or to bend the neck to one side. The gait is staggering and uncertain, the bird walking backwards, sidewise or in a circle. Sometimes irregular and unusual movements are made, or the bird falls to the ground fluttering and making convulsive movements with the legs, or may lie for some minutes powerless to move. In some cases there are epileptiform spasms which may often be stopped by a touch, in other cases there is great stupefaction and drowsiness.

As *treatment* apply cold water or ice to the head and hold it in position until the head is thoroughly cooled. Give internally 30 grains of Epsom salts, or one and one-half grains of calomel, or two teaspoonfuls of castor oil. Keep the affected bird in a quiet, cool, and shady place. If there is not entire recovery under this treatment, try bromide of potassium one to five grains three times a day dissolved in a tablespoonful of water. In case of intestinal parasites endeavor to dislodge these with appropriate remedies.

HEMORRHAGE OF THE BRAIN, APOPLEXY.

Apoplexy is the result of a rupture of one of the blood vessels of the brain and pressure from the escaped blood. Such accidents are attributed to stimulating food, to overfeeding and mechanical injuries, to violent exertion and to straining in laying eggs (hens being sometimes found dead on the nest from this cause).

There are no premonitory symptoms in this disease. The bird is attacked suddenly, falls nearly or quite insensible, or dies upon the nest.

In most cases, treatment is impossible as the bird dies before it can be administered. In mild attacks the treatment should be the same as recommended for congestion of the brain. As preventive measures, regulate the rations and give plenty of exercise.

EPILEPSY.

Epilepsy is a disease characterized by convulsive attacks with loss of consciousness, which occur from time to time and are popularly known as fits. It is sometimes caused by pressure upon the brain (tumors), sometimes by intestinal parasites, and often no apparent cause can be discovered.

When attacked the bird falls to the ground, the legs

and wings are moved convulsively, it may lie upon the back or abdomen, with the legs spread, the head thrown back, the bill and eyelids opening and closing alternately, and the eyeball turned backwards. After a time, the attack subsides and the bird resumes its usual appearance.

Treatment is not very successful unless it is found that the trouble is due to intestinal worms. Otherwise, unless the bird is very valuable for show purposes, it is better that it should be destroyed when the symptoms of epilepsy are first observed. Some recommend bromide of potash 3 to 5 grains two or three times a day.

CHAPTER VIII.

Diseases of the Heart and Blood Vessels.

PERICARDITIS, INFLAMMATION OF THE PERICARDIUM, DROPSY OF THE HEART SAC ENDOCARDITIS, INFLAMMATION OF THE INTERNAL MEMBRANE OF THE HEART HYPERTROPHY OF THE HEART RUPTURE OF THE HEART AND LARGE BLOOD VESSELS.

PERICARDITIS, INFLAMMATION OF THE PERICARDIUM, DROPSY OF THE HEART SAC.

THIS disease is quite common with poultry, and is often found associated with inflammation of the lining membrane of the heart, with enlargement of the heart, with inflammation of the lungs and air sacs, and with soreness of the joints. Cadeac and Megnin are of the opinion on account of the coexistence of these different troubles that the pericarditis of birds is often of a rheumatic nature.

Symptoms.— There is great weakness, difficult breathing, the head being thrown backwards, and the breath drawn through the mouth in order to obtain sufficient air. If forced to run the bird soon falls. In a case observed by Hill there was tumultuous action of the heart and occasional spasms.

Examination after death shows the pericardium or heart sac distended with a considerable quantity of liquid which has been thrown out as a consequence of the inflammation. There are, also, in many cases

thick false membranes adherent to both the heart and pericardium and sometimes uniting the two.

TREATMENT.— The disease is usually not recognized in a bird until it is examined after death. If there are repeated cases in the same flock it is an indication of exposure to sudden changes of temperature, or to extreme cold and dampness, and these conditions should be removed. Give two to four grains of bicarbonate of soda to each bird daily in the drinking water.

ENDOCARDITIS, INFLAMMATION OF THE INTERNAL MEMBRANE OF THE HEART.

The delicate membrane lining the interior of the auricles and ventricles is subject to inflammation as well as the pericardium, but much less frequently. The symptoms are not to be distinguished in fowls from those of pericarditis. On examination after death the internal surface of the heart is found reddened and deposits of coagulated lymph adhering to it. What has been said as to the cause and treatment of pericarditis in fowls applies equally to this disease.

HYPERTROPHY OF THE HEART.

Hypertrophy or enlargement of the heart has been sometimes seen in fowls and particularly in pigeons. It appears to be partly due to the great timidity of pigeons with which the least fright is sufficient to cause palpitations.

SYMPTOMS.— The symptoms of hypertrophy are violent beating of the heart which is sometimes so extreme as to cause rupture of blood vessels and the escape of blood from several points on the body at the same time. Hypertrophy affects most frequently the walls and valves of the right side of the heart (Cadeac).

RUPTURE OF THE HEART AND LARGE BLOOD VESSELS.

Rupture of the heart or large vessels accompanied by fatal hemorrhage appears to be quite common with birds. The cause is over exertion in trying to escape when being chased, or it may be due to compression of small birds in the hands, or to other injuries. It is most common in full blooded or plethoric individuals. Cadeac has noted its occurrence twice with birds affected with diphtheria. This accident results in speedy death, and can neither be foreseen nor treated. Megnin recommends that parrots, on account of being predisposed to this trouble, should constantly be given, for drink, water which has been made alkaline with bicarbonate of soda.

CHAPTER IX.

Parasites and Diseases of the Skin.

THE EPIZOA OR PARASITES LIVING UPON THE EXTERNAL SURFACE OF THE BODY—SCABIES OR MANGE OF THE BODY—SCABIES CAUSED BY EPIDERMOPTES—SCABIES CAUSED BY SARCOPTES, DEPLUMING SCABIES—FAVUS—CHICKEN POX, SORE HEAD, PIGEON POX.

THE EPIZOA OR PARASITES LIVING UPON THE EXTERNAL SURFACE OF THE BODY.

OUR domesticated birds are liable to be infested with a considerable number of species of external parasites. These parasites living upon the surface of the body are grouped as *epizoa*. Space will not permit a detailed description of the various species, but the following list gives the scientific name, the popular name, when possible, and the kind of bird infested:

GROUP I. EPIZOA WHICH SUCK BLOOD OR GNAW THE FLESH.

Pulex avium. The bird flea. Fowls, pigeons, and many other birds.

Acanthia columbaria. Dove-cote bug. Fowls and pigeons.

Dermestes lardarius, *Tenebrio molitor*, *Necrophorus*, *Silpha* (Various species.) — Larvæ of Coleoptera — Young pigeons.

Argas reflexus. Pigeon tick. Pigeons.

Leptus autumnalis. Harvest bug. Fowls.

Dermanyssus gallinæ. Red mite. Poultry, pigeons, and house birds.

GROUP II. EPIZOA WHICH CAUSE SCABIES OR MANGE.

Epidermoptes bifurcatus. Fowls.
Epidermoptes bilobatus. Fowls.
Sarcoptes lævis, var. *gallinæ*. Scab mite. Fowls.
Sarcoptes lævis, var. *columbæ*. Scab mite. Pigeons.
Sarcoptes mutans. Leg scabies mite. Fowls, Guinea fowls, turkeys, and cage birds.

GROUP III. EPIZOA WHICH LIVE IN THE CONNECTIVE TISSUE OR AIR SACS.

Cytodites nudus. Air sac mite. Fowls.
Harpirhynchus nidulans. Connective tissue mite. Pigeons.
Laminosioptes cysticola. Connective tissue mite. Fowls.
Falciger rostratus. Pigeons.

GROUP IV. EPIZOA WHICH LIVE UPON OR WITHIN THE FEATHERS, OR UPON THE SKIN, SOME BEING INOFFENSIVE WHILE OTHERS INJURE THE PLUMAGE OR CAUSE ITCHING.

Goniodes dissimilis. Louse. Fowls.
Goniodes stylifer. Louse. Guinea fowls and turkeys.
Goniodes falcicornis Louse. Peacocks.
Goniodes minor. Louse. Pigeons.
Goniodes numidianus. Louse. Guinea fowls.
Goniodes parviceps. Louse. Peacocks.
Goniocotes gigas. Louse. Fowls.
Goniocotes hologaster. Louse. Fowls.
Goniocotes rectangulatus. Louse. Guinea fowls and peacocks.
Lipeurus anatis. Louse. Ducks.
Lipeurus anseris. Louse. Geese.
Lipeurus caponis. Louse. Fowls and Guinea fowls.
Lipeurus columbæ. Louse. Pigeons.
Lipeurus crassicornis. Louse. Geese.
Lipeurus heterographus. Louse. Fowls.
Lipeurus numidæ. Louse. Guinea fowls.
Lipeurus meleagridis. Louse. Turkeys.
Menopon biseriatum. Louse. Fowls and Turkeys.
Menopon latum. Louse. Pigeons.
Menopon numidæ. Louse. Guinea fowls.
Menopon pallidum. Louse. Fowls.

Menopon phœostomum. Louse. Peacocks.
Docophorus icterodes. Louse. Ducks and geese.
Trinoton anseris. Louse. Geese.
Trinoton continuum. Louse. Geese.
Trinoton luridum. Louse. Ducks.
Trinoton lituratum. Louse. Geese.
Colpocephalum turbinatum. Louse. Pigeons.
Cheyletiella heteropalpa. Mite. Pigeons.
Syringophilus bipectinatus. Mite. Fowls, Guinea fowls and pigeons.
Syringophilus uncinatus. Mite. Peacocks.
Dermoglyphus elongatus. Mite. Fowls and Guinea fowls.
Dermoglyphus minor. Mite. Fowls and Guinea fowls.
Dermoglyphus varians. Mite. Guinea fowls.
Freyana anatina. Mite. Ducks.
Freyana chanayi. Mite. Turkeys.
Megninia asternalis. Mite. Fowls and Pigeons.
Megninia cubitalis. Mite. Fowls.
Megninia ginglymura. Mite. Turkeys.
Megninia velata. Mite. Ducks.
Pterolichus obtuses. Mite. Fowls.
Pterolichus uncinatus. Mite. Turkeys.
Pterophagus strictus. Mite. Pigeons.

General Considerations.— We have grouped together, as epizoa which suck blood or gnaw the flesh, a number of parasites which produce somewhat similar effects, although, zoologically speaking, these pests differ very widely. They resemble each other in that they do not remain constantly upon the birds, most of the varieties hiding about the roosts or houses during the day, and coming out of their concealment to make their attacks by night. They puncture the skin, and suck blood for their nourishment. The coleopterous larvæ gnaw the skin, and even the superficial muscles of the neck and abdomen of young pigeons, producing serious wounds and often causing death.

The bird flea is most commonly found tormenting pigeons and more rarely attacks fowls. The dove-cote bug closely resembles the ordinary bedbug, and is thought by some to be identical with it. When the pigeon and poultry-houses become infested with this insect, it multiplies rapidly and is extremely pernicious in its effects. The tick also lives in the pigeon-cotes, and hides during the day in the cracks and holes, coming out at night to attack the birds. Young pigeons are the preferred victims, and so much blood is taken from them that they die of exhaustion in from ten to fifteen days. The older birds are driven from their nests when sitting, and altogether it may be said that pigeon raising becomes difficult or impossible while these pests are allowed to remain. They are found most frequently on the neck or beneath the breast, but may fasten themselves to the skin of any part of the body. The mature females are about one-fourth inch in length. These parasites may wander a considerable distance, and are sometimes found in adjacent fowl-houses, and even in dwelling-houses. They are said not to trouble fowls, but as they sometimes bite children or even grown people causing painful swellings, it would not be surprising if it were found that they occasionally also attack poultry.

This tick lives a long time without food of any kind, and it may subsist for generations on dead organic matter. It is, therefore, a troublesome pest to exterminate when it is once established on any premises.

The harvest bug is a minute red insect about one-sixtieth of an inch long, which is common in some sections in the Summer and Fall. It preferably at-

tacks small animals, but often swarms upon man if its habitat is invaded. It punctures and even penetrates the skin, causing small swellings and almost insupportable itching. Fowls are sometimes attacked, the effects being most serious with chickens hatched late in Summer or in the Autumn. The parasites fix themselves to the skin at the base of the feathers producing such intense irritation as to induce epileptiform symptoms leading to death in a few days. The mortality from this cause is sometimes considerable.

The red mite, or *dermanyssus gallinæ*, is the most common and most perniciously active of all the parasites which attack birds. It is from 1-35 to 1-40 inch in length, yellowish, white, or dark red in color according as it is fasting or is more or less filled with blood. This parasite hides by day in the crevices and corners of the buildings, nests, perches, floors, etc., where it may be found in great clusters, and at night the individuals composing these clusters scatter themselves over the birds, and by pricking the skin fill themselves with blood. They are injurious not only on account of the blood which is abstracted, but because of the itching, pain, and loss of rest which is a necessary consequence of their activity.

Young pigeons, chickens, and cage birds are the greatest sufferers; their skin becomes pale and bloodless, they lose their usual vigor and alertness, become emaciated, and may finally die from exhaustion. The red mite is not usually found upon the fowls when they are examined during the day, for its natural tendency is to confine its foraging to the night, but when it is allowed to multiply until very abundant the fowls are infested both day and night, and it be-

comes, apparently at least, a permanent parasite. According to Zurn, these mites sometimes enter the nasal cavities of young pigeons and chickens and set up a catarrhal inflammation, and they have also been found in the external opening of the ear.

The red mite may get upon people and cause considerable itching and some irritation of the skin; and it may, also, attack horses and other animals stabled near the poultry-roosts. It causes horses to rub and bite themselves, the hair over the affected places is lost, and there is an eruption similar to that which occurs in the common mange.

The epizoa of our second group are all mites. The *Epidermoptes* cause a form of scabies characterized by the production of dry, grayish-yellow crusts or scales. The disease is seen on any part of the body, but only rarely about the head.

The *Sarcoptes lævis* produces the true scabies of fowls and pigeons. The skin is not much affected but the feathers break and are shed from the affected surfaces. This disease and the scabies of the legs will be treated with all necessary detail at the end of the general article on the epizoa.

The animal parasites, which live in the connective tissue and air sacs might, perhaps, be more properly placed among the entozoa. They are all mites, and some of them pass a portion of their existence upon the surface of the body. It is most convenient, therefore, to consider them in connection with the other mites. The *Cytodites nudus* lives in the air sacs and connective tissue of fowls and pheasants. They are found in the trachea, bronchi, lungs, and the various air sacs including those of the bones. They have also been reported as found in the thoracic and peritoneal

cavities. Some authors state that they have observed them in yellow, miliary tubercles of the body cavities, lungs, liver, and kidneys. Large numbers of the *Cytodites* may exist in the air sacs without their presence being suspected during the life of the bird. When they are very numerous in the bronchi they cause irritation of the mucous membrane, catarrh and coughing. Megnin states that they may cause death by congestion and obstruction of the bronchial tubes. Gerlach and Zundel believe that the *Cytodites* may cause enteritis and peritonitis. In small numbers these mites are not very injurious, but when birds are badly infested they become anæmic, lose flesh, stop laying eggs, show catarrhal symptoms, droop and die.

The *Harpirhynchus nidulans* lives in tumors of the skin on pigeons and sparrows. When present in small numbers only it is nearly harmless, and, at most, causes slight local irritation and disturbance to the growth of the feathers. If very numerous, there is impaired nutrition, loss of flesh, and frequently a fatal ending.

The *Laminosioptes cysticola* lives in the connective tissue of the *Gallinaceæ* where it may cause irritation and the formation of tubercles, in the center of which are found the mites. They often exist without affecting the health of the birds, but when in large numbers there are the usual symptoms produced by the epizoa, *i. e.*, bloodlessness, weakness, loss of flesh, and, finally, death.

The *Falciger rostratus* of the pigeon, which is really one of the feather mites, is able to introduce itself into the connective tissue beneath the skin, which it enters by way of the feather follicles, and there spends a portion of its life. Robertson examined a

considerable number of both wild and tame pigeons and rarely found the connective tissue free from this parasite. He found it chiefly in the subcutaneous connective tissue around the large veins of the neck, and on the surface of the pericardium. No disturbance of the health has been observed to result from the presence of this parasite.

Passing now to the fourth group of epizoa, those which live upon, or within, or among the feathers, but do not bite or puncture the skin, we find included an extensive list of lice and mites. The lice of birds belong exclusively to the pennivorous varieties, that is, they subsist upon the feathers, and perhaps also upon the epidermic scales, but they do not suck blood. It is a curious fact that the blood-sucking lice all live upon the mammalia. The lice of birds vary greatly in size, the largest varieties being one-sixth of an inch long, and the smallest not more than one-thirtieth of an inch in length.

Young chickens hatched under hens nearly always have lice upon them. These are found upon the head and under the throat, where they have fixed themselves to the feathers near to the skin, and may be mistaken for pin-feathers upon superficial examination. When badly infested, the parasites may also be seen under the wings and about the vent. A number of different kinds of lice may be found at one time on the same bird, and, it may also be added, each species of birds has its own species of lice. The lice are more or less injurious to the plumage of infested birds, they cause itching by roaming over the skin, and they prevent the birds from obtaining their proper rest.

The mites of the fourth group cause little or no in-

convenience to the birds which they infest. Some live between the barbules of the feathers, others live within the quills, and these are sometimes called feather mites. The *Cheyletus* lives at the base of the feathers. The *Syringophilus* lives within the quills of the tail, the wing, and the wing-coverts. The quills of the affected feathers lose their transparency and are filled with an opaque powder, which, upon microscopical examination, is found to consist of the parasites, their excreta, the skins which they have shed and the *debris* of the interior of the quill. It is supposed that this alteration of the feather has no effect upon the health of the bird. The *Dermoglyphus* and *Pterolichus* also live within the quills.

Symptoms.—Small chickens do not thrive, and if badly infested they droop and die. The larger chickens and grown birds, when severely tormented by external parasites, lose flesh, the skin and comb become pale and bloodless; the birds are scratching, picking and dusting themselves continually. Unable to rest either day or night, and losing comparatively large quantities of blood, the birds rapidly become emaciated, sitting hens forsake their nests, the feathers become broken and drop out, and the skin becomes abraded and sore. The fowls no longer thrive, egg production is greatly diminished or arrested, and occasionally a bird is found dead.

By opening the feathers carefully about the head, neck, under the wings, or about the vent of the fowls, lice may be seen moving about. Persons going about the roosting-places are covered with the vermin, and an examination of the roosts and crevices of the building near the roosts will reveal large clusters of

the red mites, some of which are light yellow in color, but the most are dark red and gorged with blood.

The existence of such pests as the bird flea and the dove-cote bug can only be determined by careful examination of the poultry-houses and pigeon-cotes. The coleoptera larvæ should be suspected in case sores are found upon the breast and neck of young pigeons. When pigeons are troubled with ticks, these parasites are often found attached to the skin on some part of the bird's body.

When the skin is irritated, inflamed, and covered with scurf, scales and crusts, with loss of feathers, or if the feathers are shed when the birds are not normally molting, an examination should be made for the mites which cause scabies. If the legs become enlarged, roughened, and scaly the effects of the *Sarcoptes mutans* are indicated. The discovery of small nodules in the skin or of miliary tubercles on the serous membranes, in the connective tissue, lungs, or other organs, should be followed by an examination with a hand lens to determine if these are due to the air-sac or connective-tissue mites.

Diagnosis.— It may be said that the diagnosis or determination of such disorders is easily made and unmistakable, if a careful search is made for the parasites. In one sense this is true, but birds are often unthrifty, leave their nests, or even die from the effects of lice or mites without the true cause being suspected. People either neglect to look for the parasites, and attribute their trouble to cholera; or if they observe a few lice they conclude that these are normally present with birds and give them no further thought. It is only after a careful examination of the roosting places by taking down the roosts and remov-

ing loose boards and thus uncovering the parasites that the extent of the plague can be appreciated. It should be remembered at all times that the external animal parasites are the most common and frequent cause of trouble in the poultry-yard and pigeon-cote. If the birds are not thriving and conducting themselves satisfactorily, look for these pests, take measures to repress them, and in most cases the results will be surprising and gratifying. When anything is the matter with a horse the maxim is *examine his feet*, and when anything is found wrong with poultry or other domesticated birds, the maxim should be *look for lice*.

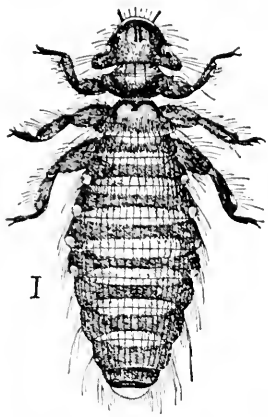

Fig. 38.—*Menopon biseriatum.* (Fowls.)

CAUSATION.—The louse plague is the result of contagion. The parasites are introduced upon birds, and they multiply and increase to a remarkable extent when the conditions are favorable. It has been estimated that the second generation from a single louse may number twenty-five hundred individuals, and the third generation may reach the enormous number of one hundred and twenty-five thousand; and all of these may be produced in the course

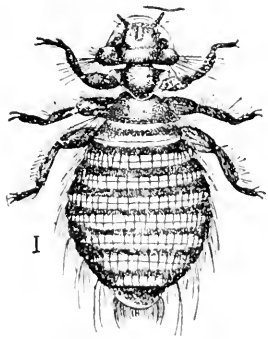

Fig. 39.—*Menopon latum.* (Pigeons.)

of eight weeks. It is not surprising, therefore, that, although birds have so few parasites upon them when well cared for that these insects can not be discovered, a few weeks of neglect and unfavorable surroundings may bring an entire change and reveal them covered with vermin, exhausted and emaciated.

It is not many years since there was a general belief in the spontaneous generation of lice from accumulations of dirt and filth, and a remnant of this belief still lingers in many minds. We may now safely banish any tendency to this antiquated theory which we may have inherited or acquired through the influence of tradition. The theory of spontaneous generation was first exploded as applied to crocodiles and reptiles of the tropical swamps and rivers; still later it was shown to be untrue with regard to lice and other insects, and finally it was disproved in relation to the very smallest organisms that are revealed by the highest powers of the microscope. Today it is admitted by all scientists that every living thing is descended from a living parent of the same nature.

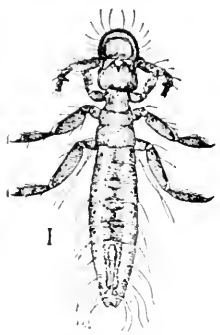

Fig. 40.—*Lipeurus columbae.* (Pigeons.)

The different species of lice and mites are as easily distinguished from each other by experts as are the different species of birds. Their peculiarities are inherited from generation to generation, and they continue to live upon the same species of birds. The hens, the turkeys, the pigeons, the ducks, the geese, and the Guinea fowls each have their peculiar species

of lice which live upon them alone, and there are but comparatively few kinds of lice which live upon two or more species of birds. We may, consequently, favor the multiplication of lice by making the conditions favorable for them, but we can not produce lice where none exist.

The conditions which favor the multiplication of lice and other external parasites are found partly in the birds and partly in the surroundings. Unhealthy or unthrifty birds, or those which from any cause lack strength and vigor are most subject to the attacks of such parasites, and may be found literally covered with them when other members of the flock are comparatively free from their attacks. For similar reasons some varieties of birds are much more likely to be infested with vermin under the same conditions than are others. There are birds so strong, healthy and vigorous that lice can not thrive upon them. Exercise, proper feeding, pure air, all have a tendency to keep the birds in a condition unfavorable to the existence of the parasites. On the other hand accumulations of manure and filth, close confinement of the birds, lack of dusting places, buildings with crevices in which the insects may hide, and damp, dark and badly ventilated houses are conditions which favor the parasites and lead to their rapid development.

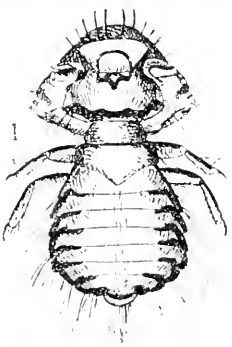

Fig. 41.—*Goniodes dissimilis.* (Fowls.)

The poultry-yard may be kept practically free from these insect pests, but there is always a liability of their introduction with purchased fowls or with birds

that have become infested at shows and other places. Contagion must, therefore, be accepted as the cause of this plague, and it should be guarded against on the same principles as are the infective elements of other communicable diseases.

TREATMENT.— Young chickens hatched under hens almost invariably have lice upon them and should be treated as soon as removed from the nests. An efficacious and safe remedy in this case is pure lard. It should be carefully rubbed into the feathers upon the top of the head and under the throat. Lard obstructs the breathing pores of the lice and soon kills them.

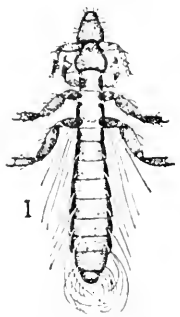

Fig. 42.
Lipeurus caponis.
Fowls.

Nothing should be mixed with the lard to increase its activity as such young birds are very sensitive to the action of irritants and are seriously injured by them. Some recommend mixing powdered sulphur with the lard for this purpose; but it should on no account be used on small chickens as it causes inflammation of the eyes and arrests the growth. Pure lard is harmless and will kill the lice, consequently it can be used with full confidence. A small quantity may also be rubbed under the wings, but this is not usually considered necessary until the chicks are a week or two old.

Chickens hatched in the incubator should be free from lice, and will be unless the incubator has in some way become infested. It is well to examine even incubator chicks occasionally for lice as the incubator or brooder may have these insects introduced into them in various ways and then become favorable places for the growth of the parasites as well as for the develop-

ment of the birds. The older birds, but not the hens with young chickens, may be anointed about the heads, under the wings, and around the vent with an ointment made by thoroughly mixing a teaspoonful of flowers of sulphur with an ounce of lard. Some use instead of this ointment or in combination with it insecticide powder, which is blown or dusted into the feathers. This operation is best performed by holding the bird by the legs, head downwards, so that the tendency of the feathers will be to fall away from the body. Then apply the powder thoroughly with a dredging box or a powder bellows. If the bird is held over a large piece of paper the powder which fails to adhere to the feathers and skin can be saved and used a second time. The powders most generally used for this purpose are pyrethrum, stavesacre seeds, and flowers of sulphur. It is considered a good plan to moisten the roots of the feathers with soapy water in order to make the pyrethrum or stavesacre powder adhere. Some poultrymen dip their fowls in a solution containing one per cent carbolic acid. This solution is made by mixing 1¼ ounces of pure carbolic acid with 1 gallon of hot water. Larger quantities may be made in the same proportion. The solution is allowed to cool and is then put in a vessel suitable for immersing the bird to be treated. The fowls should be held in this liquid for about a minute and care should be taken to wet every portion of the body and head. Creolin will probably prove more satisfactory for this treat-

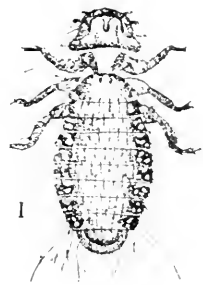

Fig. 43. — *Menopon pallidum*. Fowls.

ment than carbolic acid, as it is equally efficacious in killing insects, but is less poisonous to birds and the odor is less objectionable to the operator. It is used in the strength of 2½ ounces mixed with a gallon of water.

The treatment of the birds with some of the substances mentioned, although it is indispensable for the control of the parasites, is not alone sufficient. The buildings must receive prompt attention and thorough treatment. The droppings should be carefully removed and mixed with fine, dry road dust, ashes or lime. Fine dust is destructive to the lice and hence should be plentifully used about the buildings, and given to the fowls in boxes so large that they can thoroughly dust themselves in it. Pyrethrum and sulphur may be mixed with the dust in such boxes and render it more deadly to the insects.

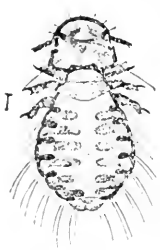

Fig. 44.—*Goniocotes hologaster.* (Fowls.)

The floor of the poultry-house or pigeon-cote should be thoroughly scraped, and covered with fresh sand or road dust. The roosts and all loose pieces of wood should be removed and then the whole inside and also the parts which have been removed should be well wetted by spraying with a solution made by dissolving 6 ounces of crude carbolic acid to the gallon of water. This should be mixed with the water at nearly the boiling point as carbolic acid does not readily mix with cold water. At least once a year the inside woodwork and walls should be given a good coat of lime-wash to which 4 ounces of crude carbolic acid for each gallon has been added. The nests should also be cleaned out, drenched with boiling water or

carbolic solution, and when dry sprinkled with insecticide powder and bedded with fresh straw. The carbolic preparations should always be used in the morning and the buildings thoroughly ventilated during the day so that the odor will not be so strong as to be injurious to the birds at night.

The treatment recommended above, if thoroughly carried out, is sufficient to keep the troublesome external parasites either eradicated or under such control that they will not prove injurious. For convenience various other methods have been devised which are more or less effectual. Some throw dry lime dust against the roof and walls of the buildings; others fumigate by burning sulphur and leaving the doors and windows closed for a few hours, there being, of course, no birds left inside at the time; still others fumigate by placing open bottles of bisulphide of carbon about the poultry-house. Aniseed is distasteful to most of the vermin of birds, and is an excellent remedy when powdered and dusted into the feathers, or when strewn into the nest boxes. A small quantity of the essential oil mixed with hot water renders this more effectual in destroying the mites about the roosts, nests and other woodwork. The essential oil may also be mixed with olive oil and rubbed upon those parts of the birds most frequented by lice; and in case of catarrh caused by the red mite

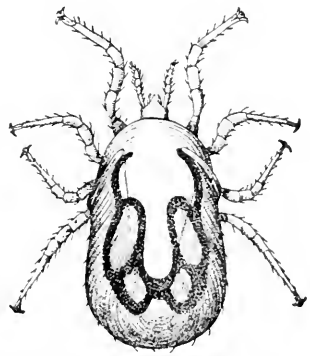

Fig. 45.—*Dermanyssus gallinæ.* Red mite. Magnified 75 diameters. Upper surface.

this mixture may be introduced into the nasal passages with a small feather.

In case the larvæ of the *Coleoptera* attack the young pigeons, the houses should be cleaned as thoroughly as possible, in the manner which has been specified, and the nests and floor should be strewn with a mixture of equal parts of pine sawdust and sand.

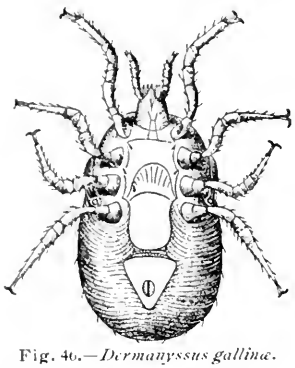

Fig. 46.—*Dermanyssus gallinæ*. Red mite. Magnified 75 diameters. Under surface.

When the *Argas* or pigeon tick is introduced upon a premises it must be destroyed by every possible means. The ticks should be carefully picked from the birds so that the head (rostrum) will not be left in the wound. They should then be crushed or burned. The infested pigeon-cotes should be thoroughly cleaned, scalded and whitewashed. Insecticide powder should be freely used upon the birds and nests.

The harvest bug may be destroyed and kept away from fowls if creolin, carbolic or sulphur ointment is freely used upon the birds.

The *Epidermoptes* are combated with creolin dips, and sulphur ointment.

The mites which live in the air sacs and connective tissue can not be reached by any kind of medication. They can only be eradicated from the flock by constant attention to all the details necessary to ensure cleanliness, by killing affected birds and by burning their carcasses.

SCABIES OR MANGE OF THE BODY.

Two varieties of scabies have been described as affecting the bodies of the domesticated birds. One form has been attributed to mites of the genus *Epidermoptes* and the other is known to be caused by the *Sarcoptes*. These varieties being quite distinct will be described separately.

SCABIES CAUSED BY EPIDERMOPTES.

The two species named *Epidermoptes bilobatus* and *Epidermoptes bifurcatus* have been observed by a number of authors, and their presence is generally coincident with a mange-like disease of the skin, although they have also been discovered upon fowls apparently free from this disease. There is, consequently, some doubt as to whether these mites produce scabies, or whether they are inoffensive. The preponderance of evidence at present indicates, however, that they are the cause of the disease which has been attributed to them.

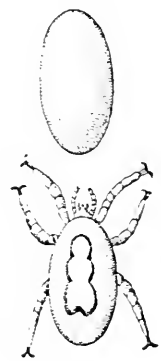

Fig. 47.—*Dermanyssus gallinæ*. Red mite. Egg and young mite. Magnified 75 diameters.

The *Epidermoptes* are very small acarina, or mites which generally live in the soft plumage or down at the surface of the skin. Usually they are not numerous but under certain conditions they multiply enormously. The skin of various parts of the body or over the entire body, with the exception of the head, becomes irritated, scurfy, and covered with large, thin, yellowish or grayish scales or crusts which accumulate particularly at the base of the feathers. In rare instances the head may be affected; but it is generally the neck, breast, the region under the wings,

and the wings themselves, that are found diseased.

The appearance of the affected parts resembles closely that seen in favus—the disease caused by the vegetable parasite known as the *Achorion Schonleinii*. Some have, therefore, suspected that the disease is really due to this fungus and that the mites are innocent of pathogenic action. The truth must be determined by future investigations.

SCABIES CAUSED BY SARCOPTES—DEPLUMING SCABIES.

This form of scabies was first observed by Railliet and Cadiot, in 1885, on a Homing Pigeon from Brussels. It was later found by Railliet to be a frequent affection of fowls. It is caused by the mite known as the *Sarcoptes laevis*. The parasite found on the pigeon is not exactly the same as that found upon fowls although both belong to the same species. The variety which lives upon the pigeon is distinguished by the term *columbæ*, and that which lives upon fowls by the term *gallinæ*. The disease is most common in Spring and Summer, disappearing in the Fall when the birds molt, and is seen again towards Spring.

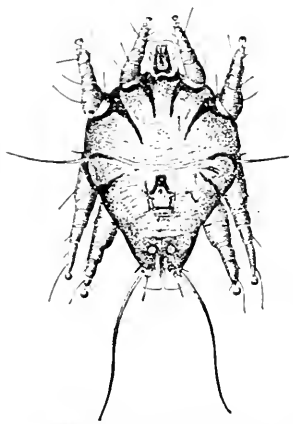

Fig. 48.—*Epidermoptes bilobatus* of the fowl; male, seen on the ventral surface; magnified 150 diameters.

The principal symptom of this trouble is a loss of feathers from spots of various sizes, situated on different parts of the body. The feathers break off at the surface of the skin, and at the root of the feather is seen a small mass of epidermic scales which is easily

crushed into powder. A microscopic examination of this powder reveals numerous mites and the debris which they produce.

The disease appears in poultry-yards as a consequence of the introduction of one or more birds already affected. It is readily communicated, develops rapidly and in a few days a whole flock is contaminated. It usually begins on the rump, the transfer of contagion being effected by copulation, and spreads rapidly to the back, the thighs and the belly. An infested cock will rapidly infect all the fowls in a poultry-yard. Often the head and the upper surface of the neck are affected early in the course of the disease. The feathers fall off at all these points, and finally the skin is denuded over a large extent of surface. The large feathers of the tail and wings and the wing-coverts are generally retained.

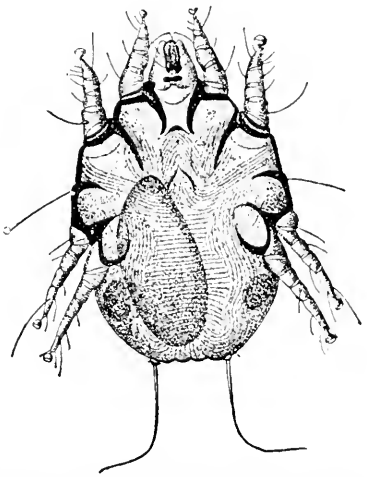

Fig. 49.—*Epidermoptes bilobatus* of the fowl; female, seen on the ventral surface; magnified 150 diameters.

The denuded skin presents a normal appearance—it is smooth, soft, of a pinkish color and not perceptibly thickened. By pulling out the feathers which remain near the invaded parts, it is easy to find, with both fowls and pigeons, a mass of epidermic scales at

the end of the quill which contains a number of the parasites.

The general health of the birds is apparently not disturbed. They remain in good flesh, and continue to lay as though they were not affected. It seems probable that much of the irregular molting, feather pulling and feather eating are due to the irritation caused by the *Sarcoptes lævis*.

TREATMENT.—The treatment of scabies of the body is not very difficult but must be persisted in until a cure is effected. Helmerich's ointment is usually recommended. A modified form more suitable for use on the bodies of birds may be prepared by thoroughly mixing the following ingredients: Flowers of sulphur, 1 dram, carbonate of potash, 20 grains, lard or vaseline, ½ ounce. This ointment should be rubbed over the affected portions of the skin and the adjacent parts. In place of this there may be substituted creolin or carbolic ointment, made by mixing

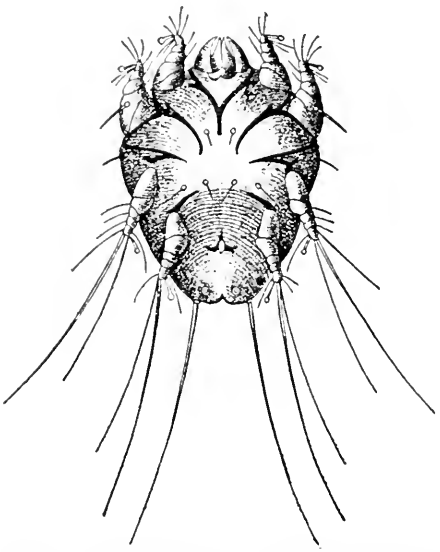

Fig. 50.—*Sarcoptes lævis*, var. *gallinæ*; male, seen on the ventral surface; magnified 200 diameters.

1 part of either of these substances with 10 parts by weight of lard or vaseline. A very large surface of the body should not be covered with strong carbolic acid preparations on account of the danger of absorption and poisoning.

Convenient liquid preparations for the treatment of scabies are made by mixing Peruvian balsam 1 ounce, alcohol 3 ounces; or, glycerine 3 ounces, water 1 ounce, carbolic acid 1 dram; or, glycerine 2 ounces, alcohol ½ ounce, water ½ ounce, creolin 1 dram. The affected parts of the body may be rubbed with either one of these preparations every four or five days until a cure is effected.

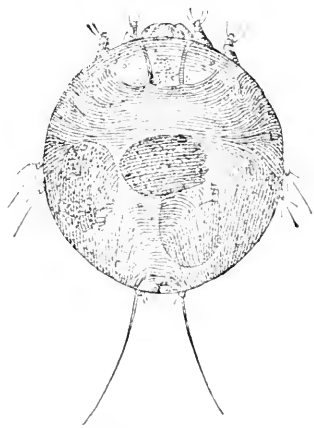

Fig. 51.—*Sarcoptes laevis*, var. *gallinæ*; ovigerous female, seen on the dorsal surface; magnified 100 diameters.

It is well to finish the treatment by dipping the birds in a two-per-cent creolin bath (2½ ounces creolin to 1 gallon of water) and to whitewash the houses with carbolated whitewash. This will kill any mites which may be left in the feathers or about the roosts.

FAVUS.

This disease is popularly known as "baldness" or "white comb." It is caused by a fungus named the *Achorion Schonleinii*, which also attacks mankind, dogs, cats, rabbits and mice. When it affects people the disease is known as *tinea favosa* and *favus*, the tendency being to accept the latter name. The para-

site was discovered in the disease of man by Remak in 1837 and more completely demonstrated by Schonlein in 1841. It was discovered as affecting cats by Jacquetant in 1847, and on mice by Bennett in 1850; while Gerlach, Muller and Leisering each published cases of it on poultry in 1858. Saint Cyr described the first case of favus on the dog in 1868 and in 1869 he discovered it on the rabbit.

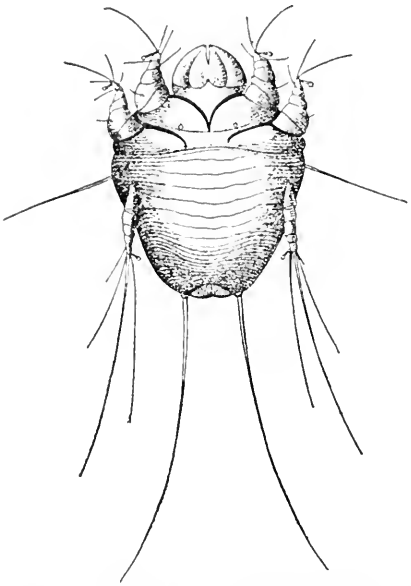

Fig. 52.—*Sarcoptes laevis*, var. *gallinæ*; larva, seen on the ventral surface; magnified 200 diameters.

SYMPTOMS.—Favus is a disease of the skin which in birds generally commences upon the comb, or other fleshy parts of the head and gradually extends to and affects the skin of the body. In rare cases it begins upon the body before the head is affected. The disease manifests itself by small white or light gray, round or irregular spots, from the size of a pinhead to that of a dime, that extend and increase in number, until nearly all of the skin of the affected part is covered. An examination of these spots shows that a thin scale or crust has formed on the surface of the skin. This crust often

develops in round or concentric deposits, raised at the border and depressed at the center, giving to the spots a cup-shaped appearance. The crust increases in thickness until in the course of a month it may be one-fourth inch or more in depth. It is then of a dirty-white color, scaly and irregular on the surface. When the crust is removed the skin is seen to be irritated and slightly excoriated. The disease extends from the bare parts of the head to the parts of the body covered with feathers. The neck, the region about the vent, and the adjoining surfaces are soon invaded. The feathers become dry, erect and brittle, they break and fall off leaving the skin denuded and covered with crusts, which are often cup-shaped, having in the center the depression in which the feather was fixed.

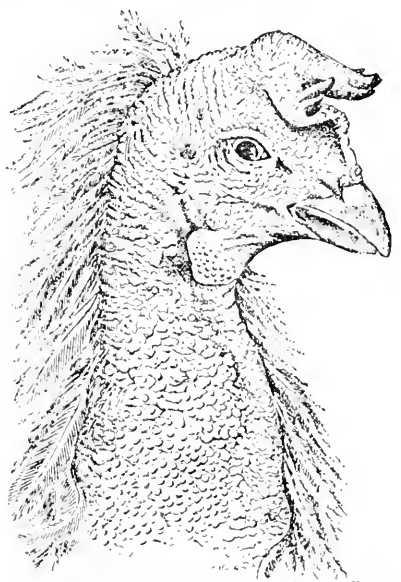

Fig. 53.—Head and neck of a fowl affected with generalized favus.

At first the general health of the bird is not visibly affected, it appears bright, eats well and conducts itself as usual. After a time, however, when a considerable area has been invaded, it manifests weakness, loses flesh, its appetite becomes irregular and it

falls into a decline which continues until the forces of the body are exhausted and it dies. During the course of the disease the affected birds give off a disagreeable odor which has been likened by some to that of moldy cheese and by others to the exhalations from mice, cat's urine, or macerating animal substances.

CAUSATION.— Favus is a contagious disease, and, as has already been stated, it is caused by a fungus which has been named *Achorion Schonleinii*. If a small particle of one of the crusts is taken, placed upon a glass slip and moistened with water or dilute acetic acid and submitted to microscopic examination at a magnification of 300 to 500 diameters, it is seen to be made up of threads or mycelium of the fungus held together by a thick, viscid, gelatinous substance which it secretes. Numerous spherical or ovoid spores are also visible both within the filaments and in a free condition. An examination of the feathers on the affected parts reveals the fact that the fungus has penetrated the shaft, filled it with crusts, and has in some cases even reached the barbs.

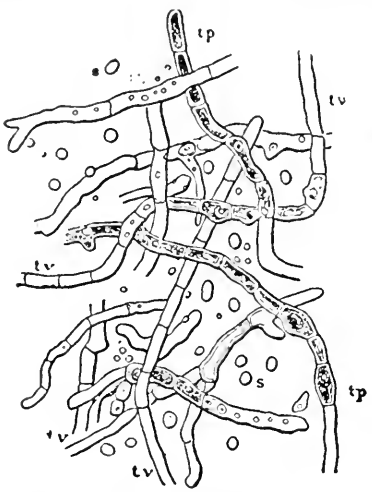

Fig. 54.—The *Achorion Schonleinii* of the favus of poultry; magnified 800 diameters. *tv*, empty tubes; *tp*, tubes filled with protoplasm and containing spores; *s*, isolated spores.

The disease may be inoculated from bird to bird,

and probably also from mice, rats, rabbits, cats and dogs to birds. On the other hand, it may probably also be communicated from birds to these animals and to children. Some authorities consider the poultry favus a distinct form of the disease and not communicable to mammals, but the weight of evidence favors the conclusion that the disease in all of these species is identical and intercommunicable. Apparently a wound or abrasion of the skin is necessary to enable the fungus to obtain a foothold. The filaments and spores suspended in water have been placed upon the combs of poultry without effect, until the surface of the skin was scratched or abraded. As fowls come into close contact with each other and often have wounds of the skin from fighting or other causes, the disease spreads rapidly among them and unless proper measures are adopted for its arrest the results may be disastrous to the flock. Young birds appear to be more susceptible to this disease than old ones, and large birds particularly of the Asiatic breeds are predisposed to it though no varieties are altogether exempt.

TREATMENT.— Favus yields readily to proper treatment if it is not allowed to develop too far before remedial measures are applied. When confined to the parts of the head that are bare of feathers, it is not difficult to manage, but when it spreads to parts covered by feathers and also affects the plumage it becomes much more serious.

It is important that the remedy used should penetrate beneath the crusts to the skin, and to secure this the crusts may be rubbed off as thoroughly as possible with a blunt instrument such as the handle of a spoon. This should be done gently so as not to cause

bleeding. After the crusts are removed dress the affected part once a day with any one of the following preparations: Tincture of iodine. Benzine 1 part, soft soap 20 parts; mix thoroughly before using. Or carbolic acid 1 part, soft soap 20 parts, to be well mixed. The carbolic preparation should not be applied to a large surface at one time as the acid may be absorbed and cause poisoning. A good ointment may be made with either calomel or red oxide of mercury 1 part to 8 parts of vaseline. If the above mentioned remedies fail a more active, but also more dangerous ointment may be made by mixing 3 grains of nitrate of silver with ½ ounce of vaseline. This ointment should be made by the druggist and carefully rubbed upon the diseased surface. Another remedy, which on account of its poisonous character should only be used as a last resort, is made by dissolving 10 grains of corrosive sublimate in an ounce of water.

In the remedies here mentioned the means are provided for effectually arresting this troublesome malady and eradicating it from the poultry-yard. If taken in time, the application of the milder preparations daily for a few days will be sufficient; but in case a number of birds become affected and particularly if feathered parts are involved, the more active agents will be required. It is, also, necessary to adopt sanitary regulations. The affected birds should be separated from the well ones, and the houses and runs should be disinfected with limewash and carbolic acid solution.

CHICKEN POX—SORE HEAD—PIGEON POX.

This disease has been for many years familiar to students of veterinary medicine, both in Europe and America. It was at first thought to be a form of

variola, allied to cow pox if not identical with it. Careful study has shown, however, that it is an entirely distinct disease. Some persons lacking a better name have called it warts. More recently it was described by Bollinger as *epithelioma contagiosum* and was by him and others supposed to be caused by the low forms of animal parasites known as *psorosperms*. The disease has, therefore, been called by some writers *cutaneous psorospermosis*. In 1897, Sanfelice published a notable paper on the subject from which it appears

Fig. 55.

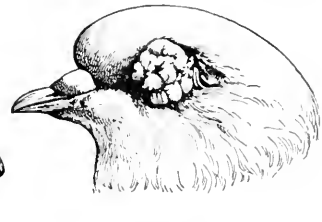

Fig. 56.

Fig. 55.—Inoculated pigeon 6 days after appearance of first symptoms.
Fig. 56.—Inoculated pigeon 10 days after appearance of first symptoms.

that chicken pox is caused by a fungus of the group now known to scientists as blastomycetes.

Chicken pox affects ordinary fowls, turkeys, pigeons, and, more rarely, geese. Pigeons, and young chickens are particularly susceptible. Grown fowls are only occasionally affected. The malady while widespread and well known is a disease of warm countries, and is usually found in Southern Europe and the Gulf Section of the United States. It is there very destructive, attacking a large proportion of the birds, and unless it is early and vigorously treated it causes much damage and many deaths.

Symptoms.—This disease chiefly affects the head of poultry, and appears as an eruption of round or oblong, yellow nodules, varying from the size of a pin-

head to that of a pea or a grain of corn. The largest are found about the beak, the nostrils, the eyelids, and upon other parts of the head that are free from feathers. They form rough, yellow masses upon the comb and wattles. The eruption may be localized where it first appears or it may extend to the feathered portions of the body.

With pigeons the eruption has a tendency to become diffuse and invades the neck, the lower surface of the body, the inner sides of the legs and wings, the rump and even the upper surface of the wings.

The nodules, which at first have somewhat the appearance of the warts ofter seen upon the hands of children, reach their full development in from five to ten days. They soon show a central depression, an opening forms, or the summit is rubbed off accidentally or by the bird's beak, after which there is a discharge of a watery, or, later, of a thick, yellowish matter which soils the feathers and which if abundant may become foul and disagreeable.

When the disease is localized, the general health of the bird does not appear to suffer, and spontaneous recovery may occur. In this case the nodules dry up and form a crust which falls off either as a whole or in particles. Generally, however, the disease extends, the birds become emaciated, the plumage is rough, the strength is exhausted, and death results. In the most violent cases, especially with pigeons, the eruption extends to the mucous membranes of the mouth and nostrils, the resulting inflammation takes on a diphtheritic form, and early death follows.

CAUSATION.—This disease has long been recognized as contagious and to spread from one bird to another. If an affected bird is introduced into a flock,

the roosting places become infected, and the contagion is spread about the premises and it is not long before other birds become diseased. Rivolta concluded that the disease was not transmitted by placing the infectious matter upon the sound skin; but Pfeiffer succeeded in causing the disease in fowls and pigeons by inoculating it through punctures of the skin. Sanfelice has repeated these experiments with the result that the disease was invariably caused in pigeons by inoculation into the eyelids; and in the case of ten pigeons with which the infectious matter was simply smeared upon the eyelids, two contracted the disease. It appears, therefore, that while an abrasion of the surface or a deeper wound facilitates the entrance of the contagion into the tissues, the parasite may in certain cases, at least, penetrate the normal skin.

Some have supposed that the bites of fleas and mosquitoes, others that the punctures of ticks produce this disease. Undoubtedly these act simply by furnishing an easy entrance for the germs. The blastomycetes or fungi appear to multiply outside of the birds' bodies, probably in the accumulations of excrement which exist in many poultry-houses. Some moisture is necessary for the growth of these germs, and hence it is not surprising that poultry raisers have observed that the disease appears in those houses which have leaky roofs or into which water can penetrate through the walls and thus moisten the droppings. It is well known that fungi are most numerous in the atmosphere during wet weather while bacteria are most numerous during dry times. This fact may account for the prevalence of sore head during wet weather. It is, also, a matter of observation that this disease is much more prevalent and fatal among late-

hatched chickens than among those raised early in the season. The development and spread of the contagion is influenced, therefore, by the condition of the poultry-houses, by the season of the year, and to a certain extent by the weather.

TREATMENT.—The prophylactic or preventive treatment consists in excluding affected birds from the premises; in keeping the poultry-houses and pigeon-cotes clean and dry; and in hatching the chickens early on farms where the disease is troublesome. Disinfection by whitewashing the houses, or spraying them thoroughly with a solution containing three to five per cent of carbolic acid and then opening them for the drying action of the sun and air is a valuable means of guarding against an outbreak of the disease.

The curative treatment consists of the local application of those remedies which have been found efficient for the destruction of the parasitic blastomycetes. Some persons have been successful by feeding sulphur, and at the same time, applying sulphur ointment twice a day to the nodules. Others have cured the affected birds by applying carbolic ointment, or glycerine containing two per cent of carbolic acid. Another treatment is to bathe the affected parts with soap and water in order to soften the crusts, and afterwards apply a solution of sulphate of copper (bluestone), a dram to ½ pint of water. Sulphate of copper has been found destructive to many kinds of fungi, and, therefore, is promising in this disease. Tincture of iodine has also been recommended, both by itself and mixed with 10 per cent of carbolic acid, but this remedy is rather severe and should only be

applied sparingly and after the others mentioned have proved ineffectual.

This local treatment should be accompanied by cleaning and disinfection of the houses, and, if possible, changing to new, uninfected runs. The feeding troughs and drinking vessels should be daily washed with boiling water.

When the disease first appears in a flock the affected birds should be at once isolated and treated, and the effort made by disinfection to prevent the further extension of the contagion.

CHAPTER X.

Diseases of the Feet and Legs.

LEG WEAKNESS—RHEUMATISM AND GOUT—SUPERFICIAL SORES—CORNS—DEEP BRUISES AND ABSCESSES—SCABIES OF THE LEGS AND FEET, SCALY LEGS.

LEG WEAKNESS.

LEG weakness is a term which is popularly used to designate any condition in which birds find it difficult or impossible to support themselves upon their legs. It may develop in young chickens kept in brooders in which the heat is not properly distributed or where there is too much bottom heat, also in those which are kept constantly upon wooden floors. It is often seen in heavy cockerels, and also occurs in flocks which have been forced or which are kept in badly ventilated and damp houses.

This trouble is probably in most cases of a rheumatic nature, affecting the muscles, tendons and joints. Frequently it consists only of bruises of the feet; while, sometimes, its nature is obscure and difficult to understand.

Symptoms.—The disease may come on gradually or suddenly. In the former case, there is first seen an unsteadiness in the walk or lameness which becomes more aggravated, until the bird, instead of standing upon its feet, sits down upon its legs-even

when eating. In the worst cases, the birds are unable even to raise themselves to a standing position.

TREATMENT.— First, examine the birds for bruised feet or inflammation of the joints and if either of these conditions is found apply local treatment as recommended in subsequent paragraphs. In all cases give cooling food, such as bran, barley, rice, green feed, skim milk or butter milk, and vegetables. Avoid condiments, meat and stimulating rations of all kinds. Give 5 grains bicarbonate of soda daily in the drinking water for grown fowls. See that the heat is properly applied in brooders, and that the birds have dry, well aired quarters.

RHEUMATISM AND GOUT.

All species of fowls and especially chickens are subject to rheumatic affections. The trouble begins with spasmodic jerking of the legs, and is followed by lameness, indisposition to remain standing, painful joints and refusal to walk. The feet and the next joint above (tibio-tarsal), are most frequently affected. After a time small swellings appear upon the sides of these joints, which are at first soft, and somewhat painful, but gradually become more firm until they feel like enlargements of the bones. Sometimes these swellings ulcerate, in which case the sores appear red, irregular in outline and bleeding. A yellowish flaky or stringy pus partly fills the sore and when this is removed the naked tendons, bones or joints may sometimes be seen. The cavities of the joints are opened to the air, fistulas develop and death of the bone occurs. The disease is chronic in its development and the advanced stages are, therefore, generally seen in old birds. The affected birds may live a long time even when the disease has progressed to the extreme

degree described above. They lose flesh, however, their plumage becomes rough and dull, diarrhea sets in and death occurs from exhaustion.

TREATMENT.—As rheumatism is usually caused by exposure to cold and dampness, the development of the disease in one or more fowls of a flock should be a warning to improve the ventilation and drainage of the houses. The buildings where the fowls live and roost should be thoroughly dry, free from draughts, yet well ventilated, and not too cold. With proper attention to these sanitary arrangements the disease should be prevented. Affected birds should have frequent change of ration with plenty of green feed. Begin treatment with a dose of Epsom salts 20 to 30 grains. The following day add 30 to 40 grains of bicarbonate of soda (baking soda) to the quart of drinking water, and give 2 or 3 grains of salicylic acid twice a day. Apply camphorated or carbolic ointment to the affected joints. The birds which are seriously affected would be better killed than treated, and the main reliance must be under any circumstances in prevention by securing proper sanitary conditions.

DISEASES OF THE FEET.

The feet of poultry are very subject to diseases which result from pricks, cuts, bruises, and other injuries. Although the weight of birds is small compared with that of most other domesticated animals, the fact that their nights are usually spent upon perches, that in flying from these perches they often alight very heavily, and that they scratch very vigorously in searching for their food, is a sufficient explanation of their peculiar liability to this class of injuries. It is convenient for our purpose to divide the diseases of the feet, which result from injuries, into

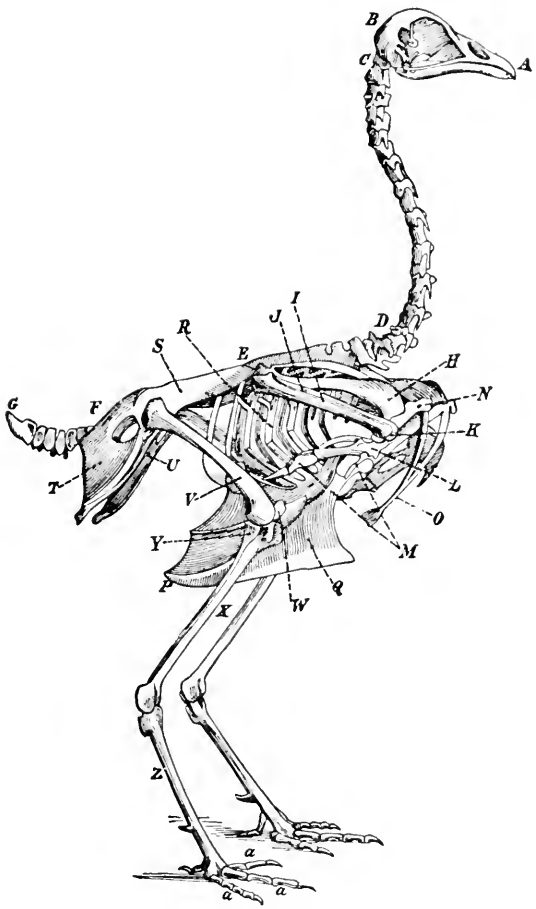

Fig. 57.—Skeleton of fowl. A, B, head; C, D, vertebræ of the neck (cervical vertebræ); D, E, dorsal vertebræ; F, G, coccygeal vertebræ; H, humerus; I, ulna; J, radius; K, carpus; L, metacarpus; M, digits; N, coracoid bone; O, forculum; P, sternum; Q, keel; R, ribs; S, ilium; T, ischium; U, pubis; V, femur; W, patella; X, tibia; Y, fibula; Z, metatarsus; a, digits.

three classes; viz., 1, superficial sores; 2, corns; 3, deep bruises and abscesses.

SUPERFICIAL SORES.

(Abrasions, Pricks, Cuts, Cracks, and Fissures.)

Such injuries are not very serious, but if the bird is seen to be lame, and particularly if there is any heat or swelling about the toes or foot, suitable measures should be taken to make the bird comfortable and prevent the development of a more dangerous condition. If there is much inflammation indicated by heat and swelling, hold the foot in water almost as warm as the hand can bear for half an hour, adding hot water from time to time to keep up the temperature. Before the bird is released apply a small quantity of boric acid ointment (boric acid 1 part, vaseline 5 parts) to the injured part. This ointment should also be applied to abrasions, cuts, and cracks where the hot water treatment is unnecessary, as it promotes rapid healing. Confine the bird to a yard covered with soft earth or young grass for a few days and do not allow it to roost upon a perch until its feet are well.

CORNS.

The condition known as corns is an inflammation and thickening of the skin on the under surface of the foot, the result of prolonged pressure, irritation, and bruises. Corns are generally caused by too small or too narrow perches which compel the fowls to grasp them tightly in order to maintain their position. This firm grasp continued night after night affects the circulation of the part of the foot that comes in closest contact with the perch. More or less irritation and inflammation is set up, which leads to multiplication and enlargement of the cells of the part, and results in swelling and thickening of the skin. A similar

condition may be caused by heavy birds flying from their perches and alighting upon a stony surface or hard floor.

Suitable precautions should be adopted to prevent the development of corns. The perches should be broad and flat, they should be of a proper height, and the floor upon which the birds alight should be covered with earth or sand so the feet will not be bruised. The affected birds should be treated by paring off the thickened epidermis, without causing bleeding, and applying boric acid ointment (see above), or painting the part with tincture of iodine.

DEEP BRUISES AND ABSCESSES.

(Bumblefoot.)

This is an aggravation of the condition known as corns. It is seen in those cases where the irritation and bruising is most severe or prolonged. The affected part is hot, painful, and more or less swollen. Sometimes an abscess has formed, or in older cases this abscess may have broken and left a suppurating sore. In the most severe cases the joints may be inflamed, and may even be penetrated by the pus channels which have formed from the abscesses.

As treatment employ the preventive measures already mentioned for corns and other injuries to the feet. Soak the feet in warm water for a half hour twice a day and poultice until the inflammation is reduced. If an abscess in the sole is indicated by a soft, fluctuating swelling of the part, it should be opened with a sharp knife. After the poulticing is completed apply boric acid ointment and protect the feet with a piece of cotton cloth. If the joints have become affected, and particularly if these communicate with the pus channels and are the seat of suppuration,

the bird should be killed, as its treatment would be unprofitable, and its entire recovery would not be probable.

SCABIES OF THE LEGS AND FEET—SCALY LEGS.

SYMPTOMS.—In scabies of the legs, the epidermic scales on the anterior surface of the legs and upon the upper surface of the foot, become loosened and elevated by the formation of a whitish crust or compacted powdery substance beneath them. The raising of these scales gives the leg a rough and enlarged appearance which is easily recognized and is very characteristic.

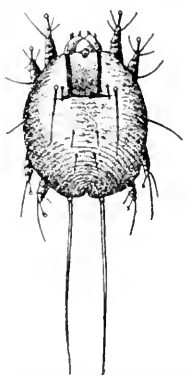

Fig. 58.—*Sarcoptes mutans* of the fowl; male; dorsal surface; magnified 100 diameters.

This form of scabies begins in the clefts between the toes and runs a very slow course. The elevation of the epidermic scales is very gradual. At first there is observed only a slight thickening of these scales, and roughness, but the continued formation of the white, powdery crust aggravates this condition, causes the scales to become detached and to assume a position nearly perpendicular to the surface. The disease extends up the leg and also along the toes until the whole shank and foot become involved. The two legs are usually affected at the same time and to about the same degree.

Unless treated the disease continues to progress, the epidermic scales are detached, the joints become affected and the birds walk with difficulty. In the most severe cases a joint or even an entire toe may become detached, the birds lose flesh and die from exhaustion. There appears to be only a moderate degree of itching.

The birds occasionally peck at or scratch the affected parts with the beak. They do this most frequently at night and in warm weather.

CAUSATION.—Scaly legs is a form of scabies or mange caused by the mite known as the *Sarcoptes mutans*. It is a strictly contagious disease although it does not spread rapidly from bird to bird, and there may be only a few noticeably affected birds in a flock. The Asiatic breeds are most susceptible to it, and many birds, even of these breeds, resist the attacks of the mites, and never show any symptoms. It attacks quite a variety of birds—fowls, turkeys, pheasants, partridges and cage birds, but has not been observed in ducks and geese. In the production of scaly legs, the *Sarcoptes mutans* penetrates beneath the epidermic scales on the upper surface of the foot and the front of the shank, and by burrowing there sets up an irritation which leads to a multiplication of the cells of the part, and an exudation of serum. It is by the union of these two products that the white, powdery crust is formed, which raises the epidermic scales from their normal position. If the crusts are removed and the under surface examined with a lens they are found to contain a large number of depressions in each of which a female, egg-containing Sarcopt is lodged. The larvæ, males and younger females are found wandering beneath the crusts. The crust contains so many cavities that it has very much the

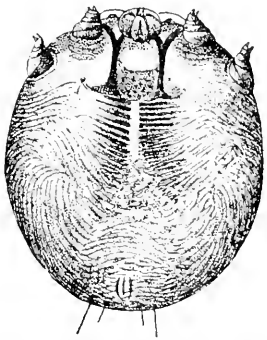

Fig. 59.—*Sarcoptes mutans* of the fowl; ovigerous female; dorsal surface; magnified 100 diameters.

appearance of dried bread. As the crust thickens by deposits on the inner surface, the cavities first formed become smaller by the drying of the walls surrounding them, and the Sarcopt abandons this location for a position nearer the flesh, where there is more moisture. The mites are, therefore, only found on the inner surface of the crust, although the cavities or honey-combed appearance exists throughout the whole substance.

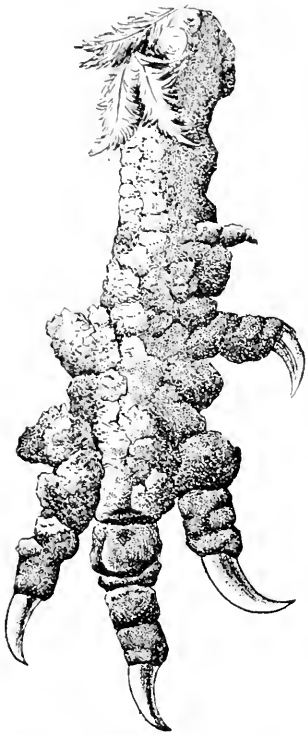

Fig. 60.—Scabies of the foot (scaly legs).

TREATMENT.—When this disease is first observed in a flock, prompt and energetic measures should be adopted to eradicate it. The affected birds should be isolated to prevent the spread of the contagion. The houses which they have occupied should be thoroughly cleaned. The roosts and other woodwork should be scalded with boiling water or covered with carbolated lime wash. The treatment of the affected birds is the same as with scabies of the body, with the single exception that the loosened scales must be removed in order to bring the remedy in contact with the mites. In order to accomplish this the legs should be soaked for a sufficient time in warm water

to which some soap has been added. When thoroughly softened the loose scales may be removed without causing bleeding. Or, a coating of soft soap may be applied to the affected parts, leaving it to act for from twelve to twenty-four hours. The legs are then placed in warm water and the scales softened and removed by gentle rubbing and traction. After this has been done the legs are dried and treated with a good coat of Helmerich's ointment, creolin ointment (1 to 10), carbolic ointment (1 to 10), or balsam of Peru. The latter may be applied daily for three or four days, and is better adapted than the other remedies to the treatment of young or delicate birds, since it is equally efficacious in destroying the mites and has little if any injurious effect upon the birds. The disease is not a difficult one to cure if the preliminary treatment is thorough and the loose scales and crusts are all removed.

CHAPTER XI.

Infectious Diseases Having a Tendency to Affect More than One Set of Organs.

TUBERCULOSIS DIPHTHERIA, DIPHTHERITIC ROUP—INFECTIOUS LEUKÆMIA FOWL CHOLERA.

TUBERCULOSIS.

THERE is frequent mention in medical literature of tuberculosis in birds. In Europe this disease appears to be very common, and it is by no means rare in the United States, if the statements of our professional men are to be accepted. The observations recorded previous to 1884, and those made since that time, which are not based upon the demonstration of the *Bacillus tuberculosis*, can not be accepted as perfectly reliable. There are a number of diseases in which the symptoms and appearances of the diseased organs are so nearly alike that a microscopical examination must be made before their nature can be determined. The existence of tuberculosis is determined by the presence of the germ which produces it. Consequently, it is only since the characters of this germ were made known that we have been able to make a reliable diagnosis in suspected cases. Koch demonstrated beyond doubt the occurrence of tuberculosis in fowls, and observed that the bacilli were extraordinarily abundant in the nod-

ules of the intestines and liver, and, also, in the contents of the intestines.

Sutton observed tuberculosis in grain-eating birds of various parts of England and states that "the occurrence of tuberculosis in these places may be regarded as showing that it is probably met with in most parts of England."

Nocard, a French veterinarian, says: "Tubercu-

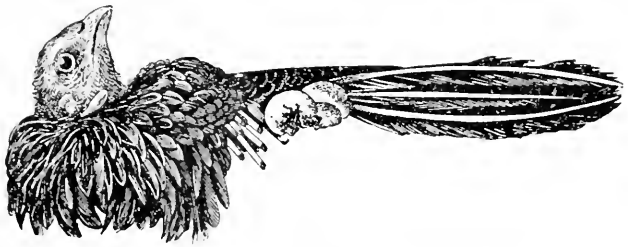

Fig. 61.—Tubercular tumor of the wing.

losis is a frequent disease with birds of the poultry-yard. It occurs with them in an epidemic form. It attacks fowls, pheasants, pigeons, turkeys, peacocks, guinea fowls, etc., and it may even be produced in small birds experimentally." In 600 autopsies of fowls made by Zuern, presumably in Germany, sixty-two, or ten per cent, were found tuberculous.

In the cases reported in the United States there appears to have been very few instances in which the diagnosis was confirmed by bacteriological examination and the demonstration of the bacillus.

Symptoms.—The symptoms which are observed in the tuberculosis of birds are common to other diseases, and, therefore, while they are valuable as an indication of the nature of the disease, they are not sufficient to permit an absolutely reliable conclusion to be reached. There is rapid and progressive emaciation, made

apparent by the loss of weight, wasting of the muscles, and prominence of the bones. The comb becomes pale, the bird loses its bright, animated expression, and in the later stages becomes quite dull and sleepy. At this time a persistent diarrhea appears which increases in intensity until the subject dies from exhaustion.

The symptoms just enumerated are those observed when the disease is confined to the internal organs. It often affects the joints and bones, when it is revealed by lameness, swellings of the joints and deformities of the bones. Occasionally ulcers form, in the pus of which many bacilli are found.

The skin and external mucous membranes are frequently affected with parrots but more rarely with other birds. There are first seen small grayish elevations which unite and form patches. Thick crusts form on these patches, becoming hard externally and soft and cheesy next to tissues. If these crusts are removed a red granular surface is exposed. Sometimes the crusts, particularly near the eye or mouth, become horny and develop into excrescences an inch or more in length.

Appearance of the Organs.— In poultry and pheasants the abdominal viscera are the most common seat of the disease. The liver is most frequently and most severely affected. The spleen is also very often attacked.

These organs are enlarged and more or less filled with tubercles which may vary in size from small whitish or grayish points, to nodules the size of a pea, or to tumors the size of a walnut which are fibrous, firm and often softened at the center. The tubercles may also be hard and calcareous. The liver is more

friable than in health, and ruptures leading to fatal hemorrhages may occur.

The peritoneum, or serous membrane of the abdominal cavity, may be covered with tubercles the size of a pin head or smaller; and when this occurs the abdomen usually contains more or less liquid.

The intestinal walls are often thickened or ulcerated, and contain tubercles of various sizes. Sometimes these are so large that they diminish the caliber of the tube or entirely obstruct it. The softening and breaking down of the tubercles on the inner surface of the intestine cause the ulcerations which are commonly seen in this disease, and from which the bacilli escape in incalculable numbers.

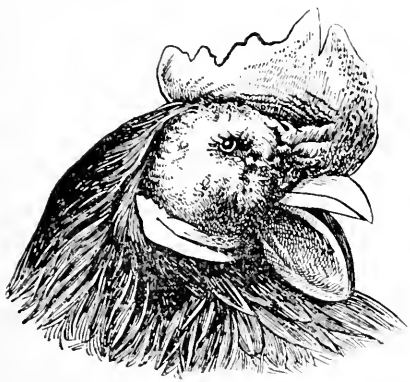

Fig. 62.—Tubercular tumor of the head.

The abdominal lymphatic glands may be invaded by the tubercular process and enlarged to the size of an egg.

Small tubercles, the size of a pin head or less, and sometimes larger tubercular masses, are occasionally found in the lungs, air-sacs, heart and pericardium, but these organs are more rarely affected than are those situated in the abdominal region.

Generalized tuberculosis is not uncommon and in this form of the disease most or all of the organs of

the body are affected—the tubercles being found even in the interior of the bones.

The joints are frequently the seat of tubercular inflammation leading to swelling, abscesses, ulcers, fistulas and loss of movement. Swellings, ulcers, and cheesy formations are sometimes seen about the mouth, eyes and nose, and horny excrescences may appear upon the skin of the head. These external manifestations are the rule with parrots.

Fig. 63.—Section of liver of bird affected with tuberculosis.

CAUSE AND NATURE.—The tuberculosis of birds, like that of mankind, is caused by a bacillus. The bacillus of birds in a general way resembles that of man, but is larger, more vigorous and hardy, and grows better outside of the body. The disease is strictly contagious, and usually appears in a flock as a consequence of bringing in new birds. That is, it results from contagion carried by birds from other diseased flocks.

Many outbreaks have been attributed to infection from eating the sputum of persons affected with consumption. The possibility of such infection is ad-

mitted by some authorities and denied by others. It is certain that poultry and pigeons are not easily infected experimentally with the tuberculosis of people, cattle and other animals which are classed together as mammals. This may sometimes be accomplished; but after one bird is infected in this way it is equally difficult to transmit the disease from this bird to other

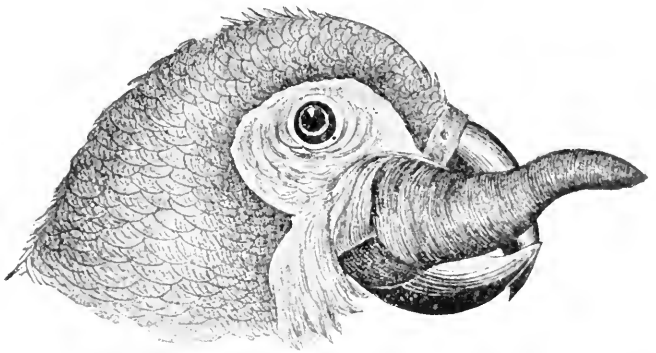

Fig. 64.—Growth of horn from region of head affected with tuberculosis.

birds. It appears, therefore, out of the question to produce a rapidly spreading outbreak of disease among fowls or pigeons by the use of human virus.

The bird or avian tuberculosis spreads rapidly from bird to bird and is easily transmitted experimentally to birds, but it has little effect upon most mammals which are very susceptible to human tuberculosis. There is, consequently, a marked difference between avian and mammalian tuberculosis. The disease in the two cases does not appear to be absolutely distinct, but should rather be regarded as two varieties of the same malady. These varieties have been developed because the bacilli have grown for a long series of years under different conditions. They may still possibly be changed from mammalian to avian

and from avian to mammalian, but such a change certainly would require much time and very favorable conditions.

A very interesting fact is that parrots are usually affected with the mammalian form of tuberculosis. The disease is quite frequently seen in these birds and it shows a great tendency to develop externally. It most commonly affects the borders of the eyes and mouth, the skin and the joints of the feet. There are at first small swellings, some of which soften, discharge their contents and become ulcers; others remain hard and continue to enlarge, while still others are covered by a horny growth of considerable thickness. When the feet are affected the joints swell and the bones are more or less deformed, leading many who are not well informed on the subject to consider the disease as simple gout.

It has been shown by experiments that it is very difficult to infect fowls and pigeons by inoculation from parrots, but rabbits, guinea pigs and dogs readily contract the disease by such inoculation. It is concluded from the various facts which have been recorded, that the tuberculosis of parrots is identical with tuberculosis or consumption in man; that parrots are infected from diseased people and may in turn infect other people. The germs of the disease are found in enormous numbers in the discharge from the ulcers, in the secretion of the nasal passages and often in the excrement. The cages are soiled with these different excretions, which soon become dry, are reduced to dust and then disseminated through the air of the apartment by the flapping of the bird's wings. People breathing this atmosphere take the germs into their lungs and in that way become infected. Other

species of cage birds may contract human tuberculosis and distribute it in the same manner.

On the other hand, as poultry and pigeons do not readily contract tuberculosis from persons, it seems probable that mankind is in no great danger of becoming infected from these birds. It is well to use reasonable precautions, however, when the disease is detected in the poultry-yard or pigeon-cote, as there are some cases recorded where it is believed that flocks of poultry have been infected by eating the sputum of human consumptives. When a bird is found to be diseased it should, of course, be safely disposed of at once; but there is no reason for the alarm and panic which have been exhibited by some owners of flocks supposed to be affected.

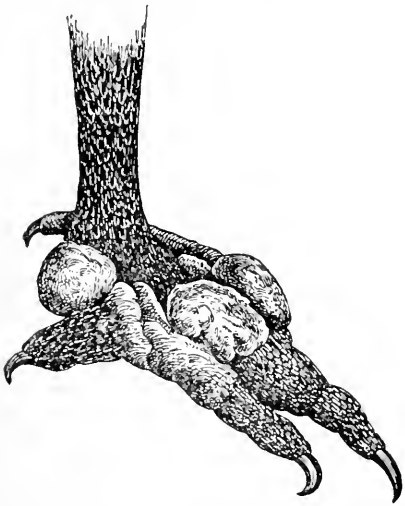

Fig. 65.—Tuberculosis of the foot (parrot).

DIAGNOSIS.—As there are a number of different conditions found in birds which simulate tuberculosis, it is well, when the disease is suspected, to have its identity confirmed by an expert. A microscopical examination showing the presence of the *Bbacillus tuberculosis* is the most reliable and satisfactory evidence. According to Nocard, the tuberculin test may be used as with cattle or other animals. The dose

stated by him is 5 to 10 centigrams for fowls, pigeons and pheasants, and 10 to 20 centigrams for geese, turkeys and peacocks.

TREATMENT.—The eradication of tuberculosis in birds from an infected premises can only be attempted with a fair prospect of success when all the birds are sacrificed. Any individuals that are preserved are liable to have ulcerations of the intestines, from which the bacilli are constantly distributed. There should, consequently, be no attempt to save any birds from an infected flock.

When the birds are all killed and disposed of by burning or deeply burying, the premises should be carefully disinfected. The manure should be carefully scraped and swept together and saturated with a five-per-cent solution of carbolic acid or mixed with lime. The floors and woodwork of the houses should be washed with boiling water or with a hot solution of carbolic acid. The feeding troughs, drinking vessels and nests should be treated in the same manner. Any yards used for penning birds should be sprinkled with the carbolic acid solution.

After the cleaning and disinfection is accomplished the premises should be opened to the sun and air for a month if possible before new birds are introduced. It is then a good plan to cover the walls and roosts with lime wash, to which 4 ounces of crude carbolic acid to the gallon has been added, and ventilate a few days longer before the houses are used. Those who scrupulously enforce these measures may be reasonably certain that the contagion will be destroyed and that the new flock may be safely introduced.

DIPHTHERIA, DIPHTHERITIC ROUP.

Among the several diseases which have been con-

founded together by modern writers under the general name of roup, one of the most prevalent and destructive is the diphtheria of birds, or diphtheritic roup. While some writers are of the opinion that contagious catarrh and diphtheria are caused by the same species of bacillus, differing only in the degree of virulence, the fact that in extensive outbreaks of the former disease there are apparently no diphtheritic membranes to be found, bears strongly against this theory and makes it desirable, at least for the present, to describe these different forms of disease separately.

The diphtheria of birds is a contagious disease which first affects the mucous membrane of the nasal passages, the eyes, the mouth, the pharynx and larynx and which may extend to the trachea, the bronchi, the air-sacs, the intestines and perhaps to other abdominal organs. The disease is characterized by a grayish-yellow fibrinous exudate, called a *false membrane*, which forms upon the mucous surface of the parts mentioned. This exudate is intimately attached to the living tissues, so that when it is forcibly removed a raw, bleeding surface may be left. Its formation may be so abundant as to obstruct the passages through which the air is drawn into the lungs. The appearance of the diseased parts bears a close resemblance to what is seen in human diphtheria, but the bacillus which is believed to cause avian diphtheria is quite distinct from that which causes the disease in children, and it is, therefore, concluded that the diphtheria of mankind and that of birds are entirely different diseases. There are some striking cases on record, however, which indicate that the diphtheria of fowls may be communicated to children in some instances and cause a serious or even fatal

diphtheritic sore throat. On the other hand it is asserted that the diphtheria of children is sometimes communicated to birds, and that the contagion may be thus preserved for a considerable time and again transmitted to children. The avian diphtheria affects the common fowl, turkeys, ducks, pea-fowls, pigeons, pheasants and probably many other varieties of birds. In some outbreaks, it is very acute, progresses with great rapidity, and destroys most of the birds attacked.

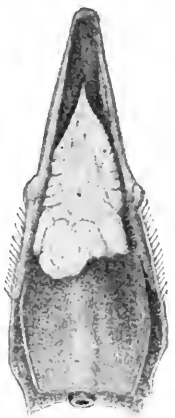

Fig. 66.— Floor of the mouth showing the diphtheritic exudate over the tongue.

SYMPTOMS.— When first attacked, the affected birds present the symptoms of common cold or catarrh. There is a watery secretion from the nostrils and often from the eyes, with general weakness and prostration greater than would be expected from simple catarrh. The birds sit with the back arched, the head and neck drawn down towards the body, the plumage roughened; the respiration is more or less obstructed, rapid, audible and strident; the vision is impaired and swallowing is difficult. There is frequent shaking of the head, sneezing and expectoration of mucous secretions. If the mouth is examined at this early period the tongue is found to be pale, while small grayish spots, shaded with black, and slightly projecting above the surface are seen along the border, the upper surface or at the base.

The following day the condition is aggravated, the temperature is several degrees above the normal, the appetite has disappeared, and there is diarrhea with

greenish or yellowish evacuations. From the open beak there escapes a thick, stringy, grayish mucus. The eyes are unnaturally dilated, projecting and partly covered with the thick secretion which has accumulated between the lids. The nostrils are obstructed by the thickened and dried secretion. Walking is irregular and difficult. The mucous membrane of the mouth and pharynx is red, congested, inflamed and shows numerous dark red elevations covered with fibrinous exudate. The patches on the tongue have increased in size, they are gray in color, dried along the edges of the tongue but soft and flattened upon its upper surface and are covered with membranous deposits. The voice often fails.

The third, fourth or fifth day, the whole interior of the mouth may be covered with false membranes obstructing almost completely the openings of the pharynx and larynx. Swallowing is very difficult or impossible and breathing is liable to be arrested at any time. The false membrane first appears as a thin yellowish or grayish layer and becomes thicker as the disease advances. With pigeons, it is cheesy (caseous) and easily detached, while with fowls it is more resistant, fibrous, and can only be removed with some force, generally leaving a raw, bleeding or ulcerated surface. Later, this membrane becomes irregular and rough on the surface, dry, fissured and of a brownish color. The decomposition of the membranes at this period gives the breath a very marked and disagreeable odor of decomposition. At this time it may be removed without causing bleeding, as the surface beneath has partly or entirely healed.

In certain cases the false membranes form in the trachea and extend to the lungs and air-sacs. There

is then great difficulty of breathing, with panting and wheezing. The bird is compelled to extend its neck and open its mouth to admit the air. The false membranes may also form in the œsophagus and intestines. This complication is particularly liable to occur with turkeys and waterfowls and is indicated by aggravation of the general symptoms with copious diarrhea and the escape of blood with the evacuations.

The membrane lining the nasal passages is often severely affected. This is usually due to an extension of the diphtheritic process by way of the fissure of the palate. By the accumulation of the exudate, the roof of the mouth is forced downwards, the eyeballs are pressed outwards, swellings appear over or near the orbital space and the head becomes deformed. The swollen parts are congested, tense, and when cut open there escapes a thick whitish liquid, or soft, yellowish, cheesy masses are found.

The conjunctiva or membrane covering the eye is, also, very frequently affected and the disease may begin at this point. The eyes are, then, red and weeping; the lids are hot, swollen and painful. The secretions, at first serous, then purulent and caseous, accumulate in the angle of the eye or glue the lids together. If large masses are allowed to collect under the lids they press upon the cornea, cause irritation and ulceration and lead to perforation with destruction of the sight.

The acute form of the disease just described is the more common, but very often it assumes a chronic form with obscure symptoms. The birds are dull, weak, lose flesh and fail to lay eggs There may be slight catarrh and difficulty of breathing and a careful examination, particularly if it be a *postmortem*

examination, may reveal patches of exudate in the nasal passages, the mouth, the pharynx or larynx. In some cases no local manifestations can be detected and diphtheria is only suspected because other members of the flock with similar symptoms present the false membranes.

The course of the disease varies from a few days in the acute form to several weeks in the chronic form. In the very acute cases the disease is exceedingly destructive and a large part of the flock may die in a few days. The chronic form may not cause many deaths, but renders the birds unproductive for weeks or months. Between these two extremes there are all gradations of virulence.

The period between exposure to the contagion and the development of the symptoms may be only three or four days or as long as two weeks. The disease produced by inoculation appears within ten days with fowls and within three days with pigeons.

CAUSATION.— The diphtheria of birds is undoubtedly contagious. It is usually introduced into a flock by the exposure of the birds to sick ones at shows or by bringing affected birds on the premises. The contagion may be carried by birds which have the disease in so mild a form that they show no symptoms of it. There is a general belief that the disease may be developed by exposure of birds to draughts of air, or by keeping them in damp, filthy and badly-ventilated houses. This opinion is probably incorrect and is accounted for by the early symptoms of acute diphtheria, and those of all stages of the chronic form, resembling the symptoms seen in catarrhs and colds. Dampness and lack of ventilation no doubt favor the maintenance and development of the contagion and

predispose the birds to the disease. It is, however, very doubtful if the disease can be originated by such conditions in the absence of direct infection from affected birds.

Bacteriological investigations made by Loeffler, Loir and Ducloux, and Moore indicate that the diphtheria of birds is caused by a non-motile bacillus 0.8 to 1.5 micro-millimeters long by 0.8 to 1.2 micro-millimeters broad, resembling somewhat the bacillus of fowl cholera, and rabbit septicæmia. There are slight differences in the descriptions given by these investigators—differences which may be accounted for by variations of the germs under dissimilar conditions. All who have carefully studied the bacillus agree in the conclusion that it is entirely distinct from human diphtheria and that these diseases have only superficial points of resemblance. It has been found, however, that a form of diphtheritic sore throat sometimes occurs in people who are working about birds affected with diphtheria; but this disease differs radically from the ordinary human diphtheria and is much less serious. There are recorded cases, moreover, in which it appears that the diphtheria of children has been communicated to birds and the contagion preserved for a considerable time in that manner. It may be that some of the cases of fatal disease in children contracted from fowls were caused by the contagion of the human form of the disease preserved in this way.

There are probably several distinct diseases which have been and are generally confounded together as diphtheria or diphtheritic roup. A disease of the nature of croupous angina has been described in pullets and young pigeons by Rivolta and Delprato and also

by Pfeiffer which was attributed by these authors to flagellate infusoria. A similar disease in pigeons believed to be caused by bacteria was investigated by Loeffler. Purulent collections about the head and œsophagus sometimes resemble diphtheria very closely. The disease of the skin known as chicken pox and sore head, caused by blastomycetes, has by some writers been called diphtheria. Aspergillosis of the mouth in pigeons and croupous enteritis of fowls produced by coccidia are also diseases which may be mistaken for diphtheria. These various diseases must be borne in mind in determining the nature of any outbreak.

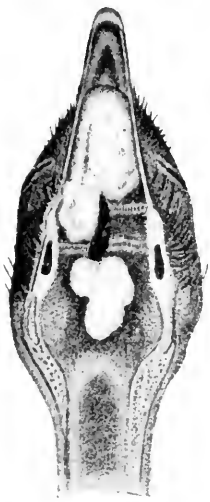

Fig. 67.— Roof of the mouth showing the exudate of diphtheria.

TREATMENT.— The treatment may be divided into three parts: 1st, measures for preventing the introduction of the contagion; 2d, measures for suppressing the disease in the flock, and 3d, treatment of individual birds.

The prevention of diphtheria is much more successful than its cure, and, besides, it saves much time and many valuable birds that will succumb before treatment can be commenced or notwithstanding treatment. Fowls should not be allowed to mingle with those on neighboring premises. If some of the birds have been to a show or if new birds have been purchased for the flock, quarantine them at a distance from the home flock for thirty days before they are allowed to go together. While in quarantine they should be examined from

time to time for symptoms of diphtheria, with special reference to the existence of grayish or yellowish patches in the mouth or eyes, or obstruction of the breathing. If at the end of thirty days they have shown no symptoms of this kind the danger may be considered past. Keep the poultry-houses clean and dry, have ample ventilation but freedom from draughts of air, and arrange the house so that the sun will shine into it a portion of the day.

If the disease appears in the flock, notwithstanding the preventive measures suggested, remove the sick birds for treatment as soon as the earliest symptoms are detected. Disinfect the poultry-house and runs with a five-per-cent solution of carbolic acid and repeat this disinfection at least once a week while the disease remains. Feed a well-balanced ration containing a small proportion of meat scrap. Burn or safely bury all dead birds.

The sick birds should be placed in a warm, ventilated, clean, dry hospital room, where they will not be exposed to draughts of air and where they can be readily caught for examination and treatment. Apply three times a day to the diphtheritic spots in the mouth and eyes a two-per-cent solution of either creolin or of pure carbolic acid in water, and if possible inject a small quantity of the same solution into the nostrils. Remove the diphtheritic membranes as soon as this can be done without causing bleeding from the affected surface and continue the application of the remedy. Tincture of iodine has been successfully applied to the diseased parts of the mouth, and a solution of salicylic acid in water 1 grain to the ounce has been recommended for the eyes. Boric acid solution of the strength of 15 grains to an ounce

of water may be applied to the eyes, nostrils or mouth and while often beneficial has the advantage of being one of the mildest and safest remedies recommended. It may be applied as frequently as convenient, and if a pledget of absorbent cotton is saturated with it and held for some minutes upon the affected part, the beneficial effects are increased. Some recommend removal of the membranes, treatment of the affected patches with boric acid solution and then covering the part with flowers of sulphur. An excellent remedy is made by dissolving thirty-five grains of chlorate of potassium and two grains of salicylic acid in one ounce of water and adding one ounce of glycerine. This liquid should be applied to the diphtheritic spots two or three times a day and may also be given internally in the dose of a teaspoonful for fowls and one-fourth to one-half as much for pigeons.

Fumigation with oil of turpentine by evaporating this in the room so that the affected birds will be forced to breathe the vapors has been found beneficial. It is best not to use fire for this evaporation, as the turpentine is very inflammable. The desired result may be obtained by heating a brick, a stone or a piece of iron at the stove, taking this to the room where the sick fowls are confined and pouring the turpentine upon the heated surface as fast as it evaporates. In this way the air of the room is charged with turpentine vapors which are inhaled by the birds at each inspiration. This fumigation should be repeated twice a day.

Stimulating and tonic remedies have been more or less successful and are especially valuable in the chronic forms of the disease. The following combination may be used: Cayenne pepper, sulphate of

quinine and sulphate of iron, of each one grain. Mix and make into pills with a small quantity of syrup. Give at one dose for fowls, and for pigeons one-third the quantity. Another tonic is made by mixing sulphate of iron 45 grains with carbonate of soda, finely pulverized, 1 dram, honey or syrup sufficient for proper consistency. It is divided into 50 pills.

Vaccination has been practiced successfully by Loir and Ducloux. The weaker vaccine is made by heating cultures of the bacilli to 55 degrees C. for half an hour. A dose of one cubic centimeter of such vaccine injected under the skin of fowls causes only a slight elevation of temperature and confers a certain degree of immunity. These birds are then inoculated with one cubic centimeter of a culture of the bacilli two months old. This second vaccination raises the immunity to such a degree that the birds are able to resist the contagion.

It has recently been proposed to treat birds with the same antitoxin that is made for human diphtheria, and very successful results are claimed for such treatment. It is just possible that this conclusion may be confirmed; but the almost unanimous testimony of bacteriologists that the germs of the human and avian diseases are entirely distinct makes such confirmation very doubtful.

For further suggestions as to treatment the reader is referred to the article on contagious catarrh.

Fowls which have been affected should not be returned to the flock for thirty days after they have apparently recovered, otherwise they may still communicate contagion.

INFECTIOUS LEUKÆMIA.

A disease of fowls which appeared to be quite com-

mon was investigated by Moore in 1894 and 1895 and described under the name *infectious leukæmia*. The term leukæmia (or leucæmia) is used to designate a condition of the blood in which there is a deficiency of coloring matter. In the disease under consideration the blood is light colored or pale owing to a considerable decrease in the number of red globules and an increase in the number of white corpuscles or leucocytes. As the malady was found to be caused by a bacterium and to be infectious, it was decided to call it *infectious leukæmia*. A sufficient number of cases have not yet been studied to permit a satisfactory description to be written; but such facts as have been noted are summarized in this article. The disease has frequently been mistaken for fowl cholera, and has been observed in Rhode Island, Maryland, District of Columbia, and Virginia. A very fatal outbreak of this disease has been observed by the author in a large brooder-house among incubator chickens from one to three weeks old.

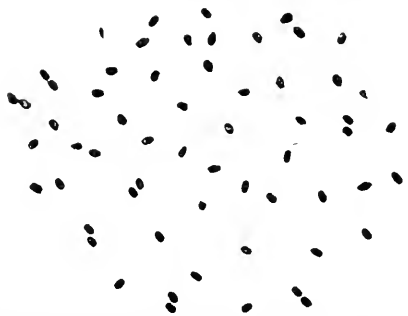

Fig. 68.—*Bacterium sanguinarium*, bouillon culture, (magnified 2,000 diameters).

SYMPTOMS.—The disease appears with a considerable elevation of temperature, reaching three degrees or more above the normal. There is drowsiness and general debility, with paleness of the mucous membranes and also of the comb, wattles, and skin about the head. The fever is of a continuous type,

generally resulting in death in from four to five days. In some cases the duration of the disease is longer and two or three weeks may elapse before the death of the bird. There is then excessive emaciation. A microscopic examination of the blood shows a marked diminution in the number of red corpuscles and an increase in the number of white ones. In one case the red corpuscles decreased from 3,744,000 per cubic millimeter to 2,133,000, and the white ones increased from 21,000 to 140,000. In another case the red corpuscles were diminished from 3,534,000 to 1,745,000, while the white ones increased from 19,000 to 245,000. There is loss of appetite with slight ruffling of the plumage, and the head drawn close to the body. There appears to be no diarrheal symptoms with this disease, or if they are sometimes seen they may be regarded as exceptional. The period of incubation is from two to four days. The alterations discovered by *postmortem* examination are confined to the liver and the blood. The liver is somewhat enlarged and dark colored, and the surface is sprinkled with minute grayish areas.

Fig. 69.—*Bacterium sanguinarium* from liver of fowl, magnified 2,000 diameters.

CAUSATION.—This disease is undoubtedly infectious and is caused by a micro-organism which Moore has named *Bacterium sanguinarium*. This germ is a non-motile, rod-shaped organism, which as found in the

tissues of fowls is from 1.2 to 1.8 micro-millimeters long and 1 to 1.3 micro-millimeters broad. It frequently appears in small clumps, but as a rule is in pairs united end to end. This germ is found in the blood and in various organs of the body.

Experimentally the disease has been produced by inoculating with pure cultures of the germs and by feeding pure cultures or the organs of affected fowls. The injection of 0.3 cubic centimeter of a fresh culture into the wing vein caused the disease and death in from three to thirteen days; usually on the fifth or sixth day. Feeding cultures or viscera of affected birds was followed by death in from seven to fifteen days, but only about half of the birds fed contracted the disease. Pigeons, rabbits, guinea pigs and mice contract the disease if inoculated with 0.2 to 0.3 cubic centimeter of culture and die within three to six days.

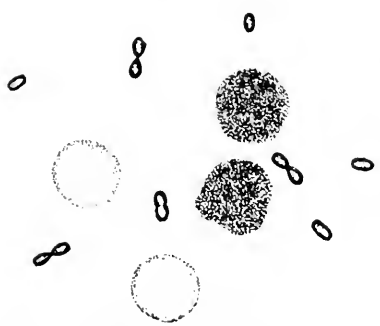

Fig. 70.—*Bacterium sanguinarium* from spleen of rabbit.

It appears probable from these investigations that the contagion in natural outbreaks is taken into the body with the food, but the disease is not readily propagated under sanitary conditions. Healthy fowls placed in cages with diseased ones did not in a single instance contract the disease. When cultures of the germs and diseased viscera were fed, only about one-half of the fowls became affected. Notwithstanding this, nearly all of one flock of about fifty fowls near

Washington, D. C. died from this disease; nearly eighty hens and pullets were lost on a farm at Tackett Mills, Va.; about fifty-five out of seventy died in a flock, on Block Island; fifty old hens died on a farm in Maryland near Washington; and several thousand small chickens died in a broiler-raising establishment in the same section. These instances are mentioned to show the destructiveness of the disease under conditions favorable to its propagation. The germ can not be considered a very virulent one, however, and, as suggested by Moore, the outbreaks appear to occur where the requirements of ordinary hygiene are not strictly complied with. In other words, this malady may be looked upon as a filth disease, and as the germ resembles in some respects the common intestinal germ known as the *Bacillus coli communis*, it is not improbable that outbreaks may occur from filth without the necessity of importing the contagion upon a premises. In the brooder-houses above referred to, the brooders were not bedded with sand as they should be, but the chicks were placed directly upon the wooden floors, which became saturated with the droppings. In the high temperature necessarily maintained in the brooders, the decomposition of such

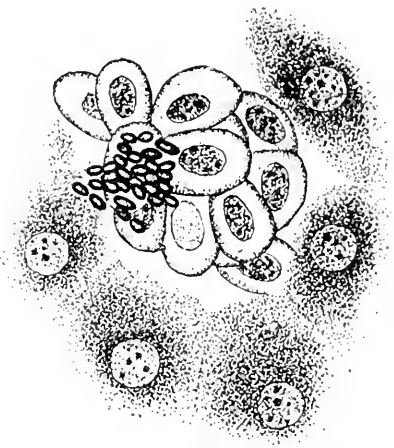

Fig. 71.—*Bacterium sanguinarium* in capillary of fowl's liver, (magnified 2,000 diameters.)

organic material was rapid, and the chicks were exposed both to the foul gaseous emanations, and to the germs which abound in putrefying excreta.

TREATMENT.— The prevention of the filth diseases is much easier than their cure, and this malady is no exception to the rule. Cleanliness, good food, pure water and ventilation are conditions antagonistic to the propagation of infectious leukæmia. With these conditions, it has been found difficult to keep up the disease experimentally, and it has not been found upon premises where they exist.

When this disease appears the poultry-houses should be cleaned and whitewashed The floors should be sprinkled with carbolic acid in solution of five-per-cent strength. Other efficient disinfectants may of course be used if more convenient. The sick fowls must be removed and isolated. Quinine in the dose of 1 to 2 grains has been suggested for the sick fowls. Sulphate of iron (copperas) in the drinking water is thought to be a good prophylactic remedy. Probably any stimulating and tonic treatment will prove beneficial after proper sanitary surroundings are secured.

It has been found experimentally that the germ is killed in five minutes by a one-per-cent solution of carbolic acid, and in ten minutes by lime water. Sulphur fumes were also effectual by three hours treatment. It is, also, destroyed by a temperature of 136.4 degrees F., and, consequently, boiling water may be used to cleanse drinking and feeding troughs and other infected articles. As the disease appears to be one of the most common to which fowls are subject, there should be ample opportunities to make

experiments for determining if any other measures of treatment are available.

FOWL CHOLERA.

This is a contagious disease of birds caused by bacteria, and transmissable by cohabitation and inoculation. It is characterized by high fever, great weakness and prostration, and usually terminates in the death of the affected bird.

HISTORY.—This disease is mentioned in some of the oldest works treating of the diseases of animals. It was studied in 1782 by Chabert who regarded it as a form of anthrax. This error is frequently repeated by writers of the present day. Fowl cholera is not a form of anthrax and has none of the characteristics of that plague which is so fatal in its results upon nearly all warm-blooded animals.

Since 1825, fowl cholera has been frequently observed in France and caused enormous losses in 1830, 1850, and above all in 1860. About 1830 it became known in Russia, Bohemia and Austria. During recent years it has been observed in about all the countries of Europe as well as in the United States.

Benjamin in 1851 considered it to be a contagious disease and remarked that people and dogs might consume with impunity, the meat of affected fowls. Delafond and others observed that it might be transmitted to birds and rabbits by using the blood, the secretions, and portions of the flesh as infective agencies. They also recognized the virulence of the excrement and the important part which this plays in the dissemination of the contagion.

The recent investigations of this disease began with an important article by Perroncito in which the specific germ of the disease was described. This was

followed by the contributions of Pasteur, who, in 1880, cultivated the germ in chicken broth and showed that its virulence might be reduced to such an extent that it could safely be used for vaccination. This is the first case in which a virulent germ was successfully modified in a laboratory and made to act as a vaccine. It led to the preparation of vaccines for a number of diseases, more particularly anthrax, black quarter, and rabies.

The disease was at about the same time investigated by the author, who gave special attention to vaccination and the effect of disinfectants in destroying this virus.

General Characters.— Fowl cholera attacks all varieties of domesticated poultry —chickens, ducks, geese, pigeons, turkeys, and also caged birds such as parrots and canaries. It also affects some species of wild birds.

The infection generally occurs by taking food or drink contaminated with the excrement of sick birds. It is, also, possible for birds to be infected through wounds of the skin or by inhalation of the germs in the form of dust suspended in the air. They often take the germs into their bodies by consuming particles of flesh or blood from the carcasses of affected birds that have died or have been killed.

This disease is generally introduced upon a farm, or in a locality, with new birds purchased for improving the flocks, or with eggs for hatching. When it exists in a district it may be disseminated by wild animals or wild birds.

Fowl cholera is communicable by inoculation to rabbits and mice. Guinea pigs are not very susceptible; the young animals may die but the adult ones

usually have nothing more than an abscess at the point of inoculation.

Symptoms.—This disease as it occurs in Europe is more rapid in its course and differs somewhat in its symptoms from outbreaks which the author has observed in the United States. The incubation in Europe is placed at 8 to 16 hours. In the case of 40 fowls inoculated by the author, the average period of incubation was 8 days, and it varied from 4 to 20 days. The virus evidently varies in its activity in this country. The duration of the disease, also, varies. With the 40 cases mentioned above it averaged 3 days.

The sick birds generally stop eating or the appetite is lessened, though occasionally they continue to eat almost to the time of death. The earliest indication of the disease, is a yellow coloration of the urates, or that part of the excrement which is excreted by the kidneys. This is in health a pure white, though it is frequently tinted with yellow as the result of other disorders than cholera. While, therefore, this yellowish color of the urates is not an absolutely certain proof of cholera, it is a valuable indication when the disease has appeared in a flock and an effort is being made to check its course by isolating birds as soon as possible after infection.

In a few cases the first symptom is a diarrhea in which the excrement is passed in large quantities and consists almost entirely of white urates mixed with colorless mucus. Generally, the diarrhea is a prominent symptom. The excrement is voided frequently and consists largely of urates suspended in a thin, transparent, sometimes frothy mucus. The urates have a deep yellow color, which in the later stages of

the disease may change to greenish or even a deep green.

Very soon after these first symptoms appear the bird separates itself from the flock, it no longer stands erect, the feathers are roughened or stand on end, the wings droop, the head is drawn down towards the body and the general outline of the bird becomes spherical or ball-shaped. At this period, there is great weakness, the affected bird becomes drowsy and may sink into a sleep which lasts during the last day or two of its life, and from which it is almost impossible to arouse it.

The crop is nearly always distended with food and apparently paralysed. There is in most cases intense thirst. If the birds are aroused and caused to walk there is at first an abundant discharge of excrement followed at short intervals by scanty evacuations.

With the beginning of diarrhea the body temperature rises to 109 degrees or 110 degrees F., which is 2 degrees to 4 degrees above the normal. The comb loses its bright hue and becomes pale and bloodless. In Europe the comb is described as dark blue, purple, or black, and some writers in the United States have referred to it in the same terms, but the author has never observed a dark comb in the cases he has seen.

Diseased birds rapidly lose in weight, they are so weak that a slight touch causes them to fall over, and they walk with great difficulty. Death may occur without a struggle or there may be convulsive movements and cries.

This disease may rapidly run through a flock destroying the greater part of the birds in a week, or it may assume a more chronic form, extend slowly, and

remain upon the premises for several weeks or months.

Postmortem Appearances.— The comb is pale and bloodless, but neither dark nor dark blue, as it has often been described, particularly in Europe. The superficial blood vessels generally contain but little blood, and there are in most cases soiled feathers about the anus, to which the excrement may adhere in considerable quantity.

The liver in nearly every case is enormously enlarged, softened, with blood vessels very apparent, often of a very dark or dark-green color. The gall bladder is distended with thick, dark bile.

The crop is generally distended with food, though no special lesions have been noticed here The stomach, viewed externally, often presents a number of circular discolorations about one-tenth of an inch in diameter, which on section are found to be small clots of extravasated blood. The small intestines are congested.

The rectum and cloaca generally present deep red lines upon their mucous membrane, evidently the first stage of inflammation, which results, in chronic cases, in thickening of the walls, especially of the rectum, the desquamation of the mucous membrane, and the formation of large ulcerous surfaces.

The mesentery is generally congested, often greatly thickened and rendered opaque by inflammation. The ureters are distended with yellow urates; the kidneys seem engorged, and on section accumulations of the tenacious, yellow urates are frequently seen. The spleen is generally normal in size and appearance, though frequently enlarged and softened.

The pericardium is sometimes distended with effu-

sion, in which case there is noticeable hyperæmia of the surface of the heart. The lungs are often, though not generally, engorged with dark blood; they are seldom, if ever, hepatized.

The blood vessels are sometimes filled with a firm clot, and contain but little liquid; at other times the blood does not coagulate at all. It seems to be those cases where the duration of the disease has been longest, in which the blood loses its property of coagulation.

The brain, in the case examined, was either normal or not very perceptibly altered. The muscles at the seat of inoculation are generally reddened, though sometimes perfectly normal.

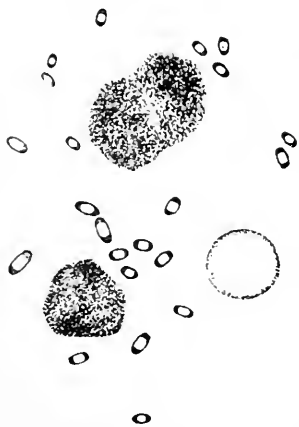

Fig. 72.—Bacilli of fowl cholera.

CAUSATION.—The cause of fowl cholera is a minute germ which under the microscope presents either a circular or oval outline. It is one of the bacteria and has been called by some a micrococcus, and by others a bacillus. It is about one fifty-thousandth of an inch broad and two or three times as long. It grows best at from 85 degrees to 105 degrees F. It has no power of movement, does not form spores, and is easily destroyed by drying, by the ordinary disinfectants, and by a temperature of 132 degrees F. for 15 minutes.

In the experiments of the author it was found that the virus was destroyed by salicylic acid 1 per cent;

benzoic acid 1 per cent; carbolic acid 1 per cent; sulphuric acid ½ per cent. Substances which failed to destroy the virulence were alcohol 20 per cent; boric acid 2 per cent; sulphate of potassium 2 per cent; iodine 0.1 per cent.

This germ may gain entrance to the body through the digestive tract, the respiratory organs, or through wounds of the skin. It diffuses itself through the blood, multiplying in this liquid, and in all of the liquids and organs of the body. Death is caused in acute cases by the toxic substances produced during the multiplication of the germ, and in chronic cases, by the disturbances of digestion, assimilation and nutrition.

The meat of infected and even of dead birds has been eaten in some countries without injurious effects to the consumers. It is assumed, therefore, that such meat is innocuous; but its sale should be prohibited in common with all meat from sick animals, or from those which have died from natural causes.

The germ of fowl cholera is fatal to rabbits, causing death in from twelve to forty-eight hours. When inoculated upon guinea pigs, sheep, horses and mankind, an abscess forms at the point of inoculation, but there are no general symptoms and recovery soon follows.

Treatment.— All forms of medical treatment for cholera have been unsatisfactory when tested sufficiently to prove their exact effects. Many preparations have been recommended, but their sanguine discoverers had not been careful to ascertain that they really were treating cholera, or they had tried them on so few birds that their results were untrustworthy.

The drugs most frequently used are sulphur,

copperas, capsicum, alum and resin, given either alone or mixed together. The effect of these remedies is either stimulating or astringent or both according to the combination that is used. Some recommend a solution made by diluting one dram of carbolic or hydrochloric acid with one quart of water. This is given to adult birds in the dose of a dessert-spoonful. We would not advise our readers to put much confidence in internal medication.

The proper manner of combating cholera is to carry out strict sanitary precautions. Remember that it is a contagious disease and that it depends upon germs which are in some way brought upon the premises from some other place where the disease exists. The contagion may be carried in various ways. Sometimes it is brought with newly purchased birds; sometimes it comes with eggs; sometimes it is carried by wild birds, and sometimes it is transported by animals. The poultryman must guard against the introduction of contagion into his flock by all means at his command. He must isolate and quarantine newly purchased birds for two weeks before they are mixed with his flock. If he hatches eggs from other yards, the nest and the young birds must be kept isolated until it is known that they are healthy, that is until the chicks are ten days old.

Dogs and other animals should be fenced out of the poultry-yards if possible. Birds which have been exhibited at shows should be quarantined for ten days after their return.

Should the disease appear in spite of precautions, isolate and disinfect. The isolation need not require a wide separation of the birds. Ten feet is sufficient distance to prevent the communication of this con-

tagion, if it is not carried in some way from pen to pen by the attendant or by animals. It does not spread to any appreciable distance through the atmosphere.

DISINFECTION.— Disinfection should be constant while this disease is on the premises. For this purpose a solution may be made by mixing one pound of carbolic acid with twenty-four pounds, or say twelve quarts, of hot water. Or one pound of sulphuric acid to fifty quarts of water may be used. The latter is the cheapest but it is more dangerous to use. When the sulphuric acid is purchased have the druggist dilute it with twice its weight of water. If thus diluted it will not burn the flesh or clothing as severely as when concentrated and there is little danger of an explosion when it is further diluted. When diluting it, always pour the acid very slowly into a comparatively large quantity of water, being careful that it does not splash into the eyes, and remember that considerable heat results. A wooden bucket is, therefore, better than a glass bottle, and, on account of its corrosive nature, metal vessels can only be used for the most dilute solution. If carefully used with proper precautions to prevent it flying into the face or eyes when diluting, sulphuric acid is the most satisfactory disinfectant. If any gets upon the flesh, apply large quantities of water at once, or it will burn very deeply; if it reaches the clothing it causes discoloration and soon destroys the fabric. It may be neutralized with ammonia or a solution of baking soda. With this digression concerning disinfectants we will now return to the methods of disinfecting. If possible move the fowls to new runs and new houses when cholera appears among them. Before they are moved,

however, separate all which are apparently sick and put these by themselves. Now saturate the floor of the old house and all of the manure which is about it with one of the disinfectants just mentioned. This may be applied conveniently with a watering can such as is used for watering flowerbeds or gardens.

The healthy fowls of the flock should be confined to a small run, and this as well as the poultry-house should be disinfected by sprinkling at least once a day. The droppings should be swept up, disinfected and removed every day. The buildings should be well whitewashed and the disinfecting effect of this application may be increased by adding one quarter of a pound of carbolic acid to each gallon of lime.

ERADICATING CHOLERA.—The fowls should be carefully watched and if any show signs of disease they should be removed at once. It is possible to arrest an outbreak of fowl cholera in a very short time by adopting such measures. If they are persevered in for two or three weeks without any more birds becoming sick the danger may be considered at an end.

The difficulty of arresting outbreaks of cholera is usually due to the fowls being allowed to roam over an unlimited range. By the time the disease is recognized, the contagion is widely scattered through the droppings of the affected birds. It is, of course, impossible to disinfect a large range, and, consequently, the birds continue to pick up the infection and one after another contract the disease until the greater part is lost.

If it is decided to kill sick birds in order to get rid of the contagion as rapidly as possible, dig a deep hole, put the birds into it and kill them there, so that their bodies and blood will be buried together. Other-

wise the blood, which is very virulent, may remain on the surface of the ground to cause another outbreak of the disease. The birds which die from cholera should in all cases be cremated or deeply buried.

VACCINATION.—Vaccination can not be recommended as a preventive. The susceptibility of different breeds of birds varies to such an extent that a vaccine which is safe for one may be deadly for another. If we had only one breed of birds to deal with there is little doubt but that vaccination would be adapted to it and made a practical preventive; but with so many breeds, each varying from the other, the task of the vaccinator is discouraging.

An interesting discovery in this connection was made by Dr. Kitt, a German veterinarian. Kitt found that the eggs of fowls that had been made immune to cholera contain something analogous to antitoxin, which may be used to produce immunity in other birds. He injects from one to two and one-quarter drams of the white of the eggs under the skin of the bird to be protected. From what we know concerning the antitoxins of other diseases, it is probable that such eggs would be more useful in treating sick birds than in vaccinating well ones against the disease.

It would not be a difficult matter to vaccinate or inoculate a number of hens until they had a very high degree of immunity, and their eggs should then, according to this doctrine, be of great remedial value. For valuable birds this treatment might be of service, but it is doubtful if there would ever be sufficient call for the remedy to warrant any one in making the necessary preparations to supply it when needed.

CHAPTER XII.

Injurious Habits or Vices.

EGG EATING—FEATHER EATING, FEATHER PULLING.

EGG EATING.

ONE of the most troublesome and injurious of the acquired habits of poultry is egg eating. Undoubtedly the habit begins in most cases by the accidental breaking of an egg in the nest, but it rapidly spreads among the flock until a large proportion of the eggs laid are purposely broken and eaten by the hens. The heavy breeds of fowls are most subject to this habit because they more frequently break their eggs by stepping upon them than do lighter birds. When an egg is broken it is too tempting a morsel to be left in the nest. The hen not only eats it, but often carries large pieces of the shell about the house or grounds, pursued by other members of the flock, each of which wants a portion. In this manner a number of individuals soon learn how appetizing are eggs and egg shells, and each in turn becomes a teacher of others.

It is plain that whatever conditions contribute to the breaking of eggs in the nests may be considered as causes of the habit. Thin-shell eggs are easily broken, and, hence, a deficiency of shell-forming constituents in the ration may be a cause. In other cases an egg may be broken for want of sufficient

straw in the nest to protect it from direct contact with the wood.

To guard against the formation of the egg-eating habit the fowls should have plenty of lime, oyster-shells, bone, or similar substances to ensure a firm shell upon the eggs. The nests should be properly supplied with straw, and artificial nest eggs should be used. In this way the danger of breaking eggs is reduced to a minimum. It is, also, well to have the nests rather dark so that if an egg is accidentally broken the hen will not discover it.

When the habit has been once acquired, these precautions are not always sufficient, and it may be necessary to construct the nests so that the eggs will roll beyond the reach of the hen. Some people place artificial eggs in the nests and about the houses so that the hens may peck at them and get the idea that they are no longer able to break egg shells. Others blow out the contents of a few eggs through a small hole in the shell and fill the space with a paste consisting largely of mustard, capsicum, aloes or other disagreeable compounds and leave these where the hens will find them.

Under any circumstances, it is best to remove the egg eaters from the remainder of the flock, and, unless they are very valuable, to kill them for the table. If they are too valuable for this treatment, then dark nests or those in which the egg rolls into a safe receptacle are the only resources.

FEATHER EATING, FEATHER PULLING.

Fowls often acquire the habit of pulling out and eating either their own feathers or the feathers of other members of the flock. This vice is acquired most frequently in the Spring or at molting time. The

first indication that the birds are pulling feathers is the loss of plumage, bareness and redness of the skin over the posterior part of the back. Sometimes the skin has become abraded by repeated pecking and sores result. If the birds are watched carefully, they will be seen to catch one or more feathers in their beaks, tear them out and swallow them. They are apparently most fond of the young, growing feathers, the quills of which are filled with blood.

Various causes have been assigned for this habit, the most probable being improper rations and insufficient exercise or idleness. In some instances, it may originate from irritation of the skin caused by animal parasites. In general, it may be said that anything which produces an abnormal appetite predisposes to feather eating.

As preventive measures, the birds should be given a free run or they should at least be made to scratch for a large part of their food. This exercise improves their digestion and gives them something to occupy their time. As in some cases, the habit is due to insufficient animal matter in the ration or to feeding too long on a single kind of grain, particularly corn, one of the first measures adopted should be a well balanced ration containing skim milk, meat, bone, vegetables or green feed and frequently varied.

The Geneva, N. Y. experiment station applied to the feathers lard or vaseline in which powdered aloes had been mixed and after continuing this treatment for some time the habit disappeared. This success was thought to be due to the disagreeable taste of the aloes. It is some trouble to apply this mixture, however, and unless the fowls are of particular value, it is probably better to rely upon exercise, variety of

food and separation of the most inveterate subjects. The skin and feathers should be carefully examined for lice and mites, and if these are found the remedies recommended for such parasites should be applied. As lack of grit may be the cause of indigestion, this essential element of the ration should receive attention, and it is well to give 6 or 8 grains daily of a mixture of equal parts of powdered gentian root and ginger. The birds should also be examined for intestinal parasites.

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